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THE
PRINCIPLES AND PRACTICE
OF
SCHOOL HYGIENE.

BY

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PREFACE.

The following pages were primarily written for students in training for educational work, as well as for those occupied in preparing them for their future duties. It is thought that a combination of the theories upon which hygienic work is based, with the principles upon which it is constructed, together with the lines upon which they should be applied in practice, will be of infinite advantage to all engaged in the art of teaching, whilst it will also be useful to all classes of society.

The addition of some chapters upon the emergencies in which teachers are often placed, in the temporary absence of a skilled medical adviser, and which forms the Second Part of the work, will be useful.

This information properly belongs to prevention, because the early application of right means for arresting commencing disease, or for mitigating the effects of accident, are as necessary in the school as are the best methods of arresting the origin of other kinds of mischief.

The Author acknowledges his great obligation to the late Dr. W. Farr, Dr. W. B. Carpenter, Dr. Parkes, and Richard Grainger. He acknowledges himself to be an earnest disciple of Edwin Chadwick and John Simon, who still live to see the fruits of the great works in which they have been engaged. Whilst the writings of the late Dr. Angus Smith, of Professor De Chaumont, and Captain Douglas Galton, with those of many other well-known writers, have been his daily companions. It may be that ideas and facts are detailed without acknowledgment of their actual source. When they have been proved by personal experience and observation, it is not always easy to determine the source from whence the first information was obtained. Without claiming originality for most of the data, they are put forth as right lines for practice, and as being the results of the application of the laws of health as carried out in various areas and under a variety of circumstances.

Time may modify or alter some of the views which are expressed, for the writer confesses that, though a sanitarian of thirty years' standing, he is still a student in sanitary work.

TABLE OF CONTENTS.

PART I.

CHAP.		PAGE
I.	Introductory,	5
II.	Site of School,	14
III.	Drainage of Schoolhouse,	28
	Ventilation of Drains,	37
	Closets, Urinals, and their Water Supply,	42
IV.	Water Supply,	51
	Baths and Bathing,	52
V.	Construction of Building,	62
VI.	Ventilation of Schools,	63
	Floor Space, Warming, and Lighting,	81
VII.	Dormitories,	105
VIII.	Physical Exercise,	118
IX.	Time allotted to Study,	133
	Overpressure in Elementary Schools,	136
	Examinations and Rewards,	139
	Punishments,	141
X.	School Desks and Seats,	146
XI.	School Costume,	155
XII.	Objects to be attained by Education,	160

PART II.

I.	School Surgery: General Directions as to Infectious Disease—usually healed by the Surgeon,	163
II.	Wounds and their Sequences,	176
III.	Cutaneous Maladies,	192
IV.	Diseases of Skin,	202
V.	Abscesses and their Allies,	216
VI.	Surgical Diseases of Mouth and Throat,	223
VII.	Burns, Scalds, and Corrosives,	229
VIII.	Drowning,	235
IX.	Arrest of Respiration by Strangulation or Suffocation,	239
X.	Dislocations and Fractures,	240
XI.	School Medicine,	260
XII.	Digestion and its Derangements,	267
XIII.	Influence of Exercise,	278
XIV.	Headaches,	287
XV.	The Care of the Eyes,	294
XVI.	The Hearing and the Ears,	311
XVII.	The Throat and Voice,	324
XVIII.	The Management of the Voice,	341
XIX.	The Mouth and Teeth,	350
XX.	Family Medicine,	358

THE
THEORY AND PRACTICE OF HYGIENE.

PART I.

CHAPTER I.

INTRODUCTORY.

THE Hygiene of School Life, or, as it is called in common parlance, 'Health at School,' is of paramount importance in connection with the subjects of Political Economy and the prosperity of the nation. It must be taken into consideration by all those who are in any way connected with the education of the young, and especially by the teacher himself. It is fully equal to that of the hygiene of the nursery; its responsibilities are even greater. Both have been very much neglected in the past by all classes of the community; but, thanks to the use of instruments of precision in scientific research such as have been employed during the middle of this century, the evidence of its necessity is so established that the education department of the country must consider and act upon its requirements.

Importance of subject.

It is in the dawn of life that decided impressions are immediately made upon the ductile material of the human constitution, which will make or mar the framework as well as the delicate machinery of the future man. Those impressions may lead him on to a life of happiness and health, or to one of unhappiness and disease, which will be to some extent consequent upon the ill-health and low bodily vigour which insanitary surroundings may produce. If the impress is put on too heavily, the result may be disastrous. The form of the body itself; the shape of a limb; the development of an individual organ; the cultivation of a sense, may be each and all interfered with in the early days of childhood: the influence thus brought to bear may stamp its impress upon the child, and determine the result as to certain careers which it shall not be able to follow. How many curved spines are due to wrong habits contracted in school! How many eyes have been deprived of their accommodating power by indulgence in positions which it is the teacher's duty to disallow! The error of the nurse or of the teacher may mar or even destroy the noblest work of God.

Effect upon frame.

The damage which results from a misunderstanding or an ignorance of the first principles of the laws of health, is manifested very clearly by statistical evidence so far as total loss is concerned; but it tells us very little of that partial mischief which so often follows from neglect of nature's laws. It is thoroughly well proved, by repeated reports, that out of every 1000 children born into the world in populous districts, at least 150 depart this life before they have lived a twelvemonth. Yet is it not the birthright of every child that it should enjoy perfect health, and reach a good old age without being subjected to the influence of hereditary diseases? The passions and the ignorance of our forefathers still produce an influence. and at the present day vice and disease are daily robbing an immense multitude of that birthright which belongs to them. It is in diminishing the incidence of

Infant mortality.

this mischief that 'Health at School' requires deep consideration. Nearly one-half of all the deaths which actually take place are those of children under five years of age. It would be waste of time to illustrate these statistical facts by reference to individual cases, but for the sake of example I may mention Birkenhead; the report for that township is now before me. For some years past, upwards of fifty per cent. of the deaths from all causes were those of children under five years of age. That is, one-half of the population never had the opportunity of going to an elementary school at all, for they 'were not' in existence at the age of five. The deaths of persons over sixty years of age were twelve per cent. only. Of late years, general hygienic measures have been adopted by the local authority in that locality. These measures have reduced the death-rate of young children to forty per cent. of the gross mortality, and have raised that of those above sixty years of age to twenty per cent. This result shows what may be done by corporate action when well directed; but no action taken by a local authority can reduce infant mortality to anything like a moderate standard unless there is at the same time an extension of hygienic knowledge among the masses; until parents and guardians know something of the first principles of sanitary laws, the reduction in infant mortality will not be great.

In large towns.

Life lengthened by hygiene.

The bearing of these points upon 'Health at School' is shown in the fact that it is sometimes asserted by intelligent people that this infant mortality is a good thing; that it weeds out from the masses, the weak, the delicate, and the diseased, and leaves behind it the stronger and better developed part of the population; that it eliminates the unhealthy, and is a benefit to the rest of mankind; and that it gives a teacher a better material to work upon; that there is a good side in the mortality among infants as well as a bad one.

Infant mortality not an advantage.

This argument is an unsound one. If the effect of unhealthy states of the community were limited to those who die; if we left out of the problem all reference to the morality of the result; there might be something said for it by the student in political economy. But it is certain that the unhealthy condition which leads to this great infant mortality, tends at the same time to lay the foundation for mischief in a large portion of those who pass the age of five years. These fundamental stages of disease will develop in an increasing ratio as time goes on, and the want of true sanitary knowledge in the nursery finds its practical demonstration in the production of manifest disease in the individual long after the nursery has been left, and even the state of pupilage in elementary schools passed through. School life may bring this hidden diathesis into light sooner or later, according to the conditions under which that school life is carried on. It may bring to the surface and expel it from the constitution on the one hand, or it may, on the other hand, fan it into activity and hasten its development into a very manifest disorder, or even into a fatal disease. This result will be brought about in one way or the other, according to the correctness or otherwise of the principles upon which the surroundings of the school as to its sanitary condition have been laid down, and the customs which may be indulged in by the scholars or insisted upon by the teacher. There is something more in 'Health at School' than simply preventing the spread of epidemic or of enthetic disease. There is something more than meets the first thoughts

Disease is founded.

Develops in school life.

which arise when we speak of the presence or absence of this or that form of epidemic, something which specially excites the dread of the teacher when the examinations of his scholars are about to commence. In addition to that, there is a *minus* quantity in the matter, which may or may not be great in the inhabitants of a particular district, but which will tell more or less upon the general health of every school, according to its surroundings and the customs which are followed within its walls. This *minus* quantity represents the depreciation in the general health which is certain to belong to some or all of the children, and will be the measure of their constitutional tendency to take on epidemic influences whenever such are presented to them either within or without the school buildings. This minus quantity will be comparatively harmless in a properly arranged and well-conducted school, but it becomes of serious importance in one in which insanitary surroundings and insanitary principles are allowed to be present; our duty, therefore, is not only to keep out all epidemic or infectious influences, but to raise the health tone of the whole body of scholars, so that this minus quantity may be gradually decreased, and an approach made to a really healthy level. There is, then, an element to be considered which is altogether outside the question of infectious diseases, and yet is intimately mixed up with them. If this minus quantity in the matter of general health is considerable, whenever the germs or exciting causes of infectious or epidemic disease find admission into a given school, they will manifest themselves with greater or less intensity according as this minus quantity is considerable or otherwise. If no germs or exciting causes of specific diseases are imported into a school at any

There is a minus quantity of health;

which opens door to infection.

particular time or season, its arrangements may be such as may prepare for the reception and propagation of an infectious malady elsewhere than within the school. The managers may have made every practicable arrangement for the exclusion of specific forms of disease, but they may be at the same time assisting to increase the minus quantity in the matter of general health and damaging the community thereby; whilst they may be pointing all the time to the efficiency of their arrangements in excluding such diseases as scarlatina or diphtheria from among their scholars.

Good hygienic surroundings necessary.

The consideration of this view of the subject is altogether outside the so-called germ theory (or the glandular theory, as it is sometimes called by those who refuse to recognise the influence of germs in the production of disease) as applied to epidemic or infectious diseases, and hitherto has not been at all considered upon its merits. Thus, although no germ of a particular disease or no particle of morbid matter may be distributed by a given school, it may yet be the means by which the general debility of the neighbourhood may be increased, because the tone of the children is lowered as regards bodily health. It may add to the number of deaths in a given district from tubercular diseases, simply because the foci of that particular form of malady, which are to be found more or less in the constitutions of children of all classes, have been allowed to increase in quantity, by the want of good hygienic surroundings in the school-house and class-rooms. If the construction of the buildings and the principles of hygiene engrafted in the school had been carried out on sound foundations, different results would have arisen. These foci of disease, which are something like particles of ice

Likeness to particles of ice in a stream

in a stream, the surface of which has been reduced to a temperature slightly below the freezing-point, increase or decrease according as the minus quantity in the matter of general health rises or falls, just as the particles of ice would grow larger or smaller according as the quantity of heat in the water became plus or minus. If the minus quantity disappear, the foci of disease dwindle away, and may be at length so dwarfed as to be incompatible with any future growth. It is probable that these foci of tubercular disease are to be more or less found in nine-tenths of the younger portion of our population; and the duty of the school authority is not only to prevent the spread of infectious diseases among their scholars, but also to prevent the increase of this morbid matter which already exists in the frame of those placed under their care. Taking the illustration for our consideration, and looking at the foci as if they were of microscopic particles of ice in a stream, the temperature of which stream rises or falls according to its surroundings; so school life adds to or diminishes the size and number of these foci in a given constitution, until they are enabled either to assert their individuality by collective action, or are so dwarfed and diminished as to altogether lose the influence which they were about to obtain. It should be thoroughly understood that the whole population of the country is more or less infected with morbid products or tendencies. These have resulted from a long-continued disobedience to the first laws of health, either in relation to hygiene or to the general nutrition of the body. These tendencies are transmitted from parent to child just as much as other conditions which belong to race. It is more than probable that, if the parentage of each child could be traced back to four generations, some

Most persons have morbid foci.

one or more of the thirty persons to whom the child has been indebted for its existence would be found to have been the subject of some disease, capable of being transmitted as a hereditary taint. These taints may be classed under several heads. There is the tubercular, the syphilitic, the gouty, the rheumatic, and the cancerous taint. It is in the power of school hygiene to interfere with the development of these taints, to dwarf them by the arrangements of the school, to prevent their increase by any teachings of the master, and to oust them from the dominion they now hold upon the constitution of man. I am not about to assert that all these hereditary taints are to be removed by attention to 'Health at School,' but at least one-half of the deaths which occur now-a-days is caused by diseases which are connected in their origin with the tubercular diathesis, and it is more especially with this taint that school hygiene has to grapple. The sanitary or insanitary condition of the school and its surroundings have in days gone by, and are even still, adding to this. The tendency to tubercular disease is often fanned into activity by ill-directed school life, and just as it can be increased by wrong steps, so it can be diminished by right ones.

Nature of hereditary taint.

There is therefore much more in the question of 'Health at School' than is implied in its ordinarily accepted meaning,—something more than arises from a consideration of the means to be taken to exclude the foci of infective diseases or to limit epidemic influences. We have to diminish in our raw material the germs of mischief which are already there; and just as we try by education to prevent the growth of evil mental passions, so we ought to try and prevent the growth of those germs of evil which

Not limited by diminution of epidemics.

are likely to undermine the health of the future man.

Our duty, therefore, is to dwarf these germs, to diminish the chances of their development after the child has left the schoolhouse, as well as to prevent the intrusion of infectious agencies which are capable of spreading from child to child.

CHAPTER II.

SITE OF SCHOOL.

Having made a few introductory remarks for the purpose of showing the wider scope of the subject of 'Health at School' than is generally understood by the term, and having pointed out that there is something to be done besides preventing the extension of infectious disease among school children, or even the prevention of that kind of disease which arises from the mere aggregation of numbers in close quarters, I will now proceed to discuss the particular points towards which attention should be especially directed. It must be borne in mind that those for whom we are providing are of an age which is peculiarly susceptible to the influence of bad hygienic surroundings, and that it is especially necessary that a schoolhouse should be constructed on the best possible hygienic principles. These in the first place resolve themselves into questions connected with the site of the school buildings and their immediate surroundings, such as—(1) the condition as to natural drainage, or the ordinary level of underground water; (2) the nature of the soil itself, especially that of the mother or virgin earth, the term virgin being applied to ground which has not been previously disturbed, at least in historic times; (3) the level of the land

Natural drainage.

Nature of soil.

upon which the buildings are placed; (4) their position with regard to other buildings and land in close proximity to them, and other portions of the same district.

No site to be chosen upon made ground.

It should be a *sine qua non* that no schoolhouse should ever be built upon ground which has been raised from some former level, or which has been 'filled up' with soil containing organic matter. Holes with notices up that 'Dry rubbish may be shot here' should be carefully avoided; and, if it be possible that the place has been so utilized in former times, it is equally objectionable for the purposes of a school. If, from the very nature of things, it is utterly impossible to get any other site, then the whole of the superadded earth should be taken out down to the level of the virgin soil; for we have to consider the atmosphere which is likely to pervade the subsoil, as well as that of the air above the so-called *terra firma*. It is only within recent years that the custom I have referred to has been general.

Measures necessary to avoid ground-air.

This consideration of the subject is intimately associated with the level of the ground-water in the subsoil. Both are connected with situation, and, if not taken into account, may seriously interfere with the proper ventilation of the school, and render good health impossible. The nature of the materials with which the school is to be erected, and the elevation at which the schoolhouse should be placed above the ordinary level of the earth, are also to be considered. I have seen the organic matter removed in a great measure, and the excavation beneath the building used as a playground, without any provision being made for the removal of the ground-air from the hole. That ground air was, from the very nature of circumstances, about the worst outside air that it was possible to provide for the children. One evil was removed, but not the other. The soil around teemed with organic *débris*, and made the atmosphere of the pit rather worse than it was before the subsoil was taken out. In the one case the *débris* occupied a portion of the space, and the sum-total of carbonic acid was rather less in the ground-air before removal than after. It would have been better to have built upon it than to excavate and build in a pit. Certain kinds of materials, and some kinds of arrangements in the building of schools, render them more capable than others of being effectually ventilated, warmed, and kept dry, and some of the suggestions now made are intended to promote the more easy, the more effectual, and less expensive plans.

Nature of ground-air.

Returning to our subject of site, we must look at it in two ways:—(1) The choice of a site for a new school when the choice is open to us. (2) The way in which to diminish to the smallest possible amount the evils which must be endured, and to decrease the effects of their incidence in any particular case when no really satisfactory site can be obtained.

Nature of ground-water.

We have to find out—(1) the nature of the subsoil, to which reference has already been made, whether it is so-called 'made ground,' and if so, the quantity and nature of organic matter which it contains; (2) the level at which the subsoil or ground-water ordinarily stands with regard to the surface, whether it is constant in its position, or varies much with the seasons, or is influenced by other causes. No school ought to be erected on any particular site until these points have been satisfactorily settled. Ground-water is the water which governs the levels of the surface wells in a particular district; it rises and falls with the rainfall, or in concurrence with some other causes, as the overflow from a river or the rise and fall of the tide. It is the water in the interstices of the soil which, finding a level, is always more or less on the move, and seldom absolutely stagnant. If the line of the ground-water rises and falls at frequent intervals, be the subsoil what it may, it cannot be a satisfactory site for a school; and if, in addition to this rise and fall of the ground-water, the subsoil is organic in its nature, or is likely to be invaded by water containing organic matter in suspension or solution, it will be quite impossible by any arrangements whatever to prevent that school, at times, from being invaded by impure air, and presenting to the children assembled therein, and in the playground surrounding it, an atmosphere which will tend to diminish their general health.

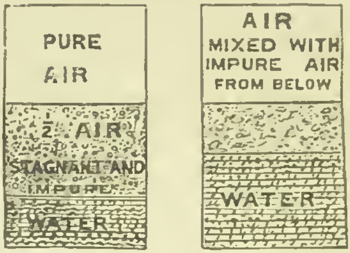
Objections to change of level

Before settling upon a site for a school, if these points cannot otherwise be certainly determined, trial holes should be dug until the level of the ground-water line is reached, unless the proposed site is a rock, or in such a position that no ground-water is likely to be found within a considerable distance from the surface. The level of the water line should be watched, and it should be noted whether it is stationary or not, for in some districts this water line is found to vary very constantly.

Level of ground-water to be noted.

The promoters will also learn from the trial hole the character of the subsoil. The condition of the ground-air is almost as important as that of the atmosphere around the school. It is a point which is not usually considered, and yet it is certain that the condition of the air in the subsoil will materially influence the health of the children. This is more likely to be injurious if the site is upon a level, low-lying plain or in a valley, than when the proposed site is upon the side of a hill. The quantity of air below the level of the soil will be more or less according to the porous nature of the soil itself; it will be in many cases equal to half the volume of the soil. When the level of the ground-water rises, the air is naturally displaced upwards; and if the soil in which the air is stagnated be loaded with organic matter, it will be so altered from its natural character as to seriously and injuriously affect the children exposed to its influence. It is this injurious nature of the ground-air which produces mischief to the inhabitants of some of the valleys in mountainous districts and land-locked islets by the seaside.

FIG 1.



It will be seen in fig. 1. how the rise of the water in the subsoil displaces the impure ground-air.

Nature of ground-air.

The air in the subsoil is comparatively stagnant, and whilst that above ground only contains at the most four parts in 10·000 of carbon dioxide (CO_2), that which is taken from below the level of the soil will often contain 4 per cent. or even 6 or 8 per cent. of that deleterious gas. It is one of the results of stagnation: the organic matter is oxidized, oxygen is removed, and carbon dioxide (or carbonic acid, as it is more commonly called) takes its place. Stagnation is the bane of health, as it is in almost everything else, and, whether it be in air or in water, stagnation allows time for mixture with injurious compounds, which form at the same time as the CO_2, such as marsh gas (CH_4). Such is the case with ground-air; there is always a much greater quantity of carbon dioxide in it than in natural air. It forms an atmosphere which is very beneficial to the vegetable kingdom, but is inversely just as injurious to human life. This impurity is much greater in the ground-air than in the ground-water, for water can only hold a certain quantity in solution; it will vary according to the nature of the subsoil, and, whatever organic matter may exist in the latter, the whole will in the course of time be reduced to simpler elements, of which carbon dioxide is sure to be one. Thus it happens that the more organic matter a given subsoil contains, the more injurious it is for that subsoil to be allowed to remain beneath the floor of any school buildings. If from the very circumstances of the case it is necessary for some such to be left *in situ*, arrangements must be made to disperse those products into the surrounding atmosphere, and to prevent them from finding their way within the area which is enclosed by the walls of the buildings. It is for this reason that it is far better for playgrounds to be turfed than covered with gravel. The vegetable kingdom is the natural protector against excess of carbon dioxide in the air.

Organic matter not to be left below school-house floor.

Water level to be uniform.

It is important for all reasons that the level of the ground-water should be uniform when it is less than fifteen feet from the surface of the earth. This uniformity can be effected, at least as regards a rise above a given level, wherever there is any regular system of drainage at hand. But it sometimes happens that a considerable extent of ground has the subsoil water raised by occasional inundations in unusually wet seasons or from imperfections in natural drainage. There is always a slow movement of this water in the earth, but not sufficiently rapid to prevent the oxidation I have mentioned. This movement may bring with it impure organic matters from a distance, and if in its progress it comes into contact with a mass of matter more than ordinarily dry, such as must exist beneath the area of any large building, the very part in which the most injury can be done is precisely that part which attracts the larger portion of organic matter from the water; and as the water line subsides, it leaves its organic matter behind it, and lays the foundation for future evils which are totally unsuspected. These underground inundations produce results which correspond with those which are known to arise in recently-drained districts. It is only within the last few years, partly by observations in this country, but more decidedly by those made in Munich and in America, that the influence of ground-air and ground-water upon the public health has been demonstrated to be great. A few years ago our soldiers had frequently to live in the basements of their barracks, with the natural result of ill health and high mortality; and it is only recently that the occupation of cellars as lodging-houses has been prohibited by law, because the evidence produced was sufficient to convince Parliament of the great evil which arises from living below the surface of the earth.

Effect of rise and fall of ground-water.

If the level of the ground-water line is moderately constant, even if it be within a few feet of the surface of the land, it is not nearly so injurious as when it rises and falls occasionally. This explains some of those anomalies which occasionally surprise us. It is sometimes seen that some places in which the level of the water is always within two feet of the surface, are more healthy than others which are farther from the banks of a given stream, in which the water line is at a lower level. Those districts which have the misfortune to be placed above and yet within the influence of a mill-dam in a porous soil, especially when the mill-head belonging to it does not rapidly fill, are much more unhealthy than those placed below the dam, where the level of the ground-water does not vary, although apparently it is the moister position of the two. The permanent level of the subsoil water should be kept as low as possible, and the soil (if it be porous) should be so arranged by means of subsoil drainage, that air should have free admission to it.

Reasons for unhealthiness in land-locked valleys.

Evil results are more marked in a sandy or gravelly soil, when these matters are not attended to, than in those sites in which the soil is more retentive. If the level of the ground-water cannot be regulated, it is better to choose a more retentive soil; but if soakage does take place, it is much more difficult to remove it from an argillaceous or retentive soil than from sand or gravel: the former also will be colder than the latter, from the continuance of evaporation, and then the cost of warming will be increased. This is not an imaginary objection. I have found spots in close proximity, one of which is sand and gravel, the other being clay, that there has been a real difference of 3° F. in temperature for a week together, which could only be explained by the difference of subsoil.

Wet clay colder than gravel.

The floor of a schoolroom should always be raised above the level of the ground, and a free ventilation provided beneath it,—unless solid blocks of wood, set in asphalte, are used,—so that no manufactory of morbid products should there be possible. There should be no openings in the floor, through which unsuspected depots of sweepings may collect, so as to form a considerable heap of disease-producing touchwood, only requiring in the course of time a germ of morbid matter to fall upon it to enable it quickly to grow a quantity of infective material. The chinks in school floors are possible sources of danger which must be prohibited.

Dry areas.

A dry area should be constructed around the outside walls, with which the sewers should by no chance be able to communicate. This area should extend below the level of the basement, and be carefully ventilated. I have seen sewage conveyed through these areas, in earthenware pipes; a settlement has taken place on one side of the area; the change in level has broken the pipes and allowed the discharge of sewage into the area. This discharge went on for some time, and was not discovered until all the people of the house were laid up with typhoid fever. In another case, in which an iron pipe was used for the purpose, the iron had oxidized at the point of junction with the outer wall, and sewage was discharged into the area. It went on for years quite unsuspected. There was a disagreeable smell in a library fifty yards away from the place of exit, which no efforts of the architect could remove until the hole in the pipe was discovered by accident. Much illness had been produced in that house for many years in consequence of this apparently unimportant defect.

Virgin earth to be reached.

It is right to remove from within the foundations all the subsoil which contains organic matter, excavating it until the virgin earth is reached. Virgin earth is that which has not been disturbed in historical times.

If the latter is itself impure, as is the case in some deltas and other more recent formations, it should be removed for a certain depth; then, if convenient, covered over with chalk, and above the chalk several inches of concrete should be placed. If chalk is not to be had, concrete or asphalte should be used, or pure clay may be well rammed down first, and a coating of asphalte placed on the surface. If it be in a district in which the ground-water must sometimes rise and fall, it should be roughly asphalted, so as to reduce the evil to a minimum. The lime in the composition of concrete is of some service, for so long as it remains as an oxide it absorbs a certain quantity of the carbon dioxide (CO_2), which may happen to penetrate it. Of course the greatest care must be taken to prevent the possibility of sewage pollution. The latter is one of the greatest dangers to which the fabrics of school buildings are exposed. It is not at all uncommon to find the subsoil polluted by these occasional discharges. Sites upon clay formations should be avoided where possible. If the geological formation is one of clay only, of course it cannot be helped; but if there is a choice, it will be found that the bed of clay is some degrees colder than a more porous subsoil. There is one advantage in clay, viz. it is not so liable to soakage from sewage; but this is fully counterbalanced by its disadvantages.

Sewage pollution to be guarded against.

If it is proposed to place a school upon the side of a hill, the site must be carefully examined: bogs are found there as well as lower down, and any position which may cover an underground stream is bad. The foot of a slope, or the bottom of a narrow valley, is not good.

Site to be clear of hill-sides.

Fig. 2 shows a common plan of building upon the side of a hill; when no other site is available, the plan shown in fig. 3 should be adopted. The dotted line shows the original line of hill front. If the side of a hill is chosen, care must be taken to provide that the buildings are kept perfectly clear of ground at a higher level. They should be raised so that the surface slopes downwards from the schoolhouse towards the rising ground. The soil should never rise immediately upwards from the building so as to allow superficial drainage or soakage to take place towards the foundations. There should be room for the free play of air on all sides. The slope of a hill which rises abruptly, and which affects more than one side of the house, or a cliff coming close to the buildings, should be avoided, even if the site can

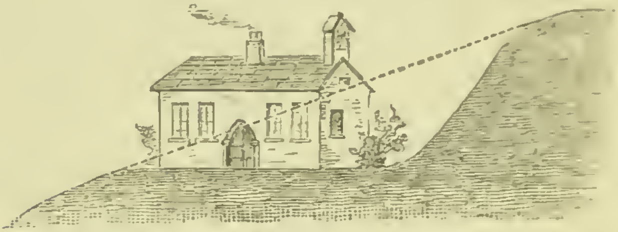


Fig. 2 shows that which must not be allowed.

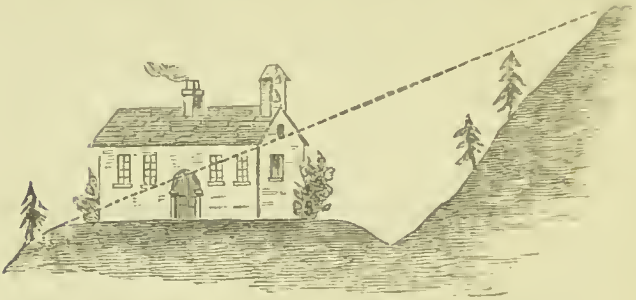


Fig. 3 shows what may be allowed when having to place a school or house on a hill-side.

Places to be avoided.

be had for nothing. The top of a hill may be a disadvantage if it be so placed as to be exposed to the influence of malaria from distant marshes, or to the smoke and used-up air of some great town immediately below. But high and bleak sites are better than low ones, when as regards the latter there are other things which are to their disadvantage. The neighbourhood of ground which is covered with rank vegetation is to be avoided; it indicates an impure subsoil. Sites which are sometimes obtained by filling up some old swamp or venerable pond are not satisfactory places for schoolhouses. It is probable that the conformation of the neighbouring strata tends to bring water in those directions, and to keep it there..

Trees to be kept at a distance from schoolhouse.

It is not good to have schoolhouses immediately and closely surrounded by trees, although a few trees in exposed situations, when kept away from the buildings, are highly advantageous. Everything which tends to allow of stagnation of air in and around the school is to be avoided; for this reason, high walls and other lofty building are to be kept as far from the grounds as possible. It is seen sometimes that at a given spot, on cold evenings, a fog first appears in a given neighbourhood: that spot is also one to be avoided. The bottom of a narrow valley is quite sure now and then to be invaded by an underground stream of water, and is not therefore a satisfactory site. If there are trees, they should be to the north or east, and sufficiently removed to prevent them from acting as impediments to ventilation.

Air and light are most important factors in the case, and nothing should be allowed to interfere with a due proportion of both being attainable on all sides of the buildings. In great cities it is not always possible to have trees in the playground; they are advantages when kept immediately away from the schoolhouse. Light and shade are necessary parts of school life, and there are times even in this country when it is beneficial to have the direct rays of the sun tempered by the pleasant green of healthy foliage. They diminish evaporation from the soil beneath, the summer temperature is lower, and the cold of winter is less, in districts in which trees abound, than in those places where there are none; decaying vegetation is not, however, to be encouraged near to a schoolhouse.

Not too close to buildings.

The building should be placed so as to obtain access for all the possible light to the classrooms. The prevailing winds should be considered, and the point made out from whence the largest amount of rain comes. The roof should be planned so that it shall carry off the water as quickly as possible, and the spouting arranged so as not to allow it to be blown upon the side walls; when it does happen, it renders them perpetually damp. It may be necessary in rainy districts to have those parts of the school which are not continually occupied placed on that side of the building from whence the most rain comes. This, however, only applies to the rainy districts of the country. Every precaution should be taken to get rid of the rainfall, so that it shall not saturate the subsoil around the school. To build a schoolhouse without spouting sufficient for the purpose, is bad. Every precaution should be taken to keep the buildings dry; the architect, as regards these arrangements, should be called upon to provide for the maximum rainfall on any day in the year, and not for an average only. It is the wettest seasons which

Roof to be considered.

Greatest rainfall to be provided for.

test the work both for spouting and drainage, and in both cases it is the maximum fall or flow which is to be met, and not the average. It is the maximum which brings disaster when it is not provided for. The rainfall which is possible within an hour or two, must be carefully calculated and properly provided for. The ill-health of a whole district may be an established fact, because a given school has been inundated by an unusually heavy thunderstorm, in consequence of defective spouting. The position, as to the points of the compass, which the schools should occupy, has also to be considered. The buildings ought so to be placed that every room which is used as a classroom should receive the direct rays of the sun during some part of the day. Verandahs are better avoided, and no architectural ideas of beauty should be allowed to introduce them if they impede direct sunlight. Exclusively northern windows are only to be admitted when required for ventilating purposes. To effect these objects, it is better for the school to be so erected that its corners are towards the points of the compass, rather than, as churches are usually built, on its direct lines. It may be that the ground beneath the school floor has to be utilized as a playground; it is a bad arrangement, and should only be allowed when it is quite impossible to obtain farther room for the purpose in proximity to the school. This point will be considered more in detail when the subject of Bodily Exercise is taken into account.

Direct rays of the sun to be obtained on classrooms.

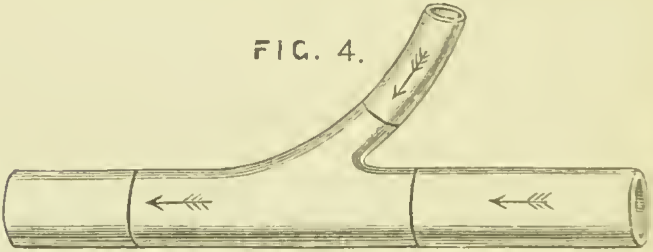
CHAPTER III.

DRAINAGE.

Drainage necessary.

A SITE without means for drainage must be declined at any price. There should always be a fall from the schoolhouse capable of being utilized for drainage purposes, and this fall should be adequate for conveying the sewage away. It should be more considerable for a small school than is absolutely required in the case of a larger one, and the smaller the rainfall of a given district, the larger the fall should be; a fall of three inches in every ten feet will generally be sufficient in this country, and it should never be less than one in fifty, except when it is possible to provide for a stream of water passing continuously through the sewer. If there is a system of sewers into which the drains from the school are to discharge, there should be a man-hole at the

FIG. 4.



A fall of one in fifty necessary.

junction with the main sewer, and the junction so arranged as to be capable of inspection without having to disturb the drain pipe. The principle is shown in fig. 8, page 36. The junction with the sewer should never be at a right angle, but slanting in the direction of the stream of sewage; right-angled pipes are not admissible, a slight curve is much more satisfactory, as in fig. 4. The arrows show the direction which the sewage takes. Stoneware or earthenware syphons are now manufactured to cut off all direct communication between the public sewer and the private house drain; they are good when the public sewer is a nuisance, provided they are examined occasionally; but if such a one is used, it ought to be provided with a ventilator between the syphon and the sewer, which should be placed close to the trap of the syphon (*vide* figs. 6 and 7). Various sanitary authorities recommend different kinds. Stiff's interceptor is something of the right sort, and so is Potts' Edinburgh chambered sewer trap, fig. 5; and several other makers have traps which are equally efficacious, but all require frequent inspection. Impervious pipes are better than bricks for sewer purposes. Bricks (unless of the Staffordshire ironstone kind, or those which have been thoroughly silicized on the surface) ought not to be used at all in sewer construction.

Impervious pipes best

It should be an established rule that no sewer pipe should be allowed to penetrate within the main walls of any school building on any pretence whatever. There should be a most perfect interception; the sewer should carry off the sewage by means of communications which should be indirect only. Sewers are necessary evils in large towns and among great congregations of people. They have their dangers. It

Communication with sewers should be indirect.

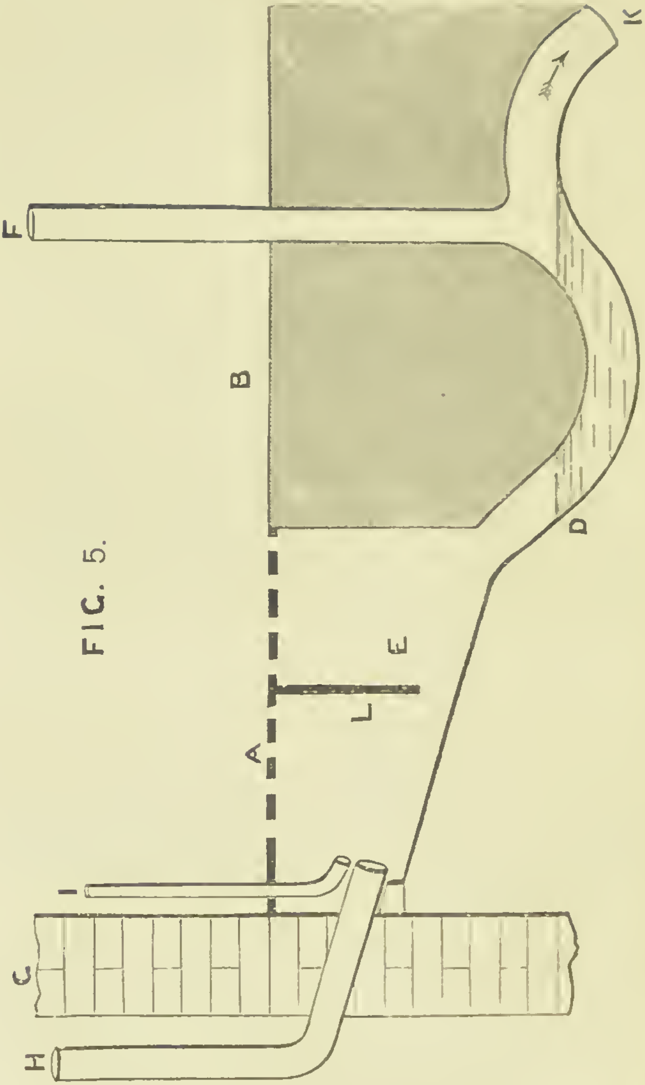


FIG. 5.

Fig. 5 shows in section the principles which should guide an architect in separating the house drainage from the general drainage of the district, when this is thought to be a necessary is not necessary to admit them within the precincts of the building, and if kept outside it is certain that they cannot act as channels for the conveyance within of unsuspected mischief. All premises, therefore, which have direct communication with the sewer should be *in annexes*, and kept outside the main walls. It may be convenient for the school staff to have W.C.'s close at hand, but the convenience is small compared with the danger. The danger is small when they are properly constructed outside the building; it is enormous if they are brought within the fabric itself, and their use must at all times be attended more or less with offensive smell immediately after use.

Sewers and drains must be laid on concrete.

It should be an established rule, that all sewers should be laid on concrete in those parts of the curtilage of the schoolhouse which are school property. This bed of concrete should be constructed before the sewer is laid down. It should be made according to the provided fall, and when once fairly laid,

proceeding. The plan adopted in the Edinburgh air chamber sewer trap, is the one which I was accustomed to show to my class when I was lecturer on State Medicine at St. Thomas's Hospital. I reported in favour of the plan before it came into general use.

G represents the wall of the house or school; H the soil pipe from the W.C.; I is a pipe from a bath, house-maid's closet, or stack pipe for rain-water; all discharge into E, which is an air-chamber sunk in the ground represented at AB. At A it is covered by an open iron grating, communicating freely with the open air. The chamber is partly divided by a diaphragm at L. D is the trap which intervenes between the pipe to main sewer K, and the air-chamber E. Any pressure upon the trap D will be obviated by the ventilating pipe F, which should be continued upwards, by the side of the house, to the highest part of the building. The soil pipe may be carried up outside the wall of the house. The size of the wall is not to scale.

will for ever prevent that particular sewer getting displaced, except by extraordinary circumstances.

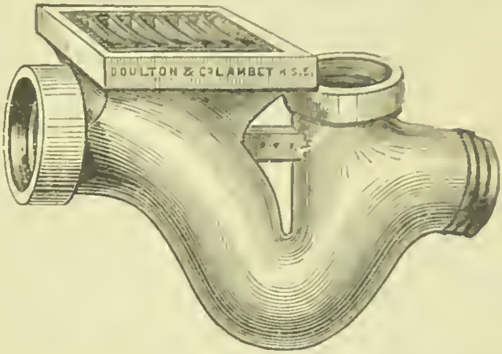


Fig. 6 shows a simple plan, which may be used for rain water or wastes, with open-air grating.

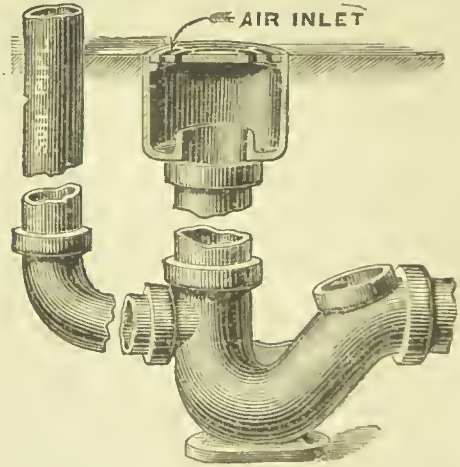


Fig. 7 shows another arrangement, with socket for ventilators to be carried up the side of the house from both sides of the syphon trap. Manufactured by Doulton.

Well laid sewers may be the means of saving a great annual expense, as well as preventing evils which will sooner or later follow when they are badly laid.

The custom of the district will determine whether the rain-water from the roof goes into the sewer or not. It is a bad custom to thus send away a valuable commodity, but rain-water butts, as too often placed, produce mischief, from the dampness which surrounds them. The rain-water should be conducted into the nearest water-course, by a separate system of drain pipes, on the principle of 'the rain to the river,' unless it be stored in properly constructed receptacles. It is a bad custom to allow the rain-water gutters to communicate directly with the sewer; and when the stack pipes discharge themselves into the ordinary house drain, because it is advisable from other circumstances to send it into the sewer, the pipe should be trapped at its junction with the sewer, so that no foul air shall find its way beneath the eaves of the school, and then be conveyed into the nearest open windows, —a custom which is very common, and occasionally recommended without thought by well-established sanitary authorities.

Rain to the river.

Rain-water pipes may be trapped.

The diameter of the drain pipe is of some importance. It is the custom for most architects to err on the side of excessive capacity. When the rain-water can be altogether excluded, there ought to be no difficulty in determining that small pipes shall be used. A drain pipe four inches in diameter, with a smooth interior, well-jointed with Stanford's joints, laid at a fall of one in forty upon a sound concrete bed, and so protected at its outward communications, that foreign bodies shall not be able to get into it (by foreign bodies I mean such things as brickbats, sweeping brooms, etc.), such a sewer ought never to give any trouble to the managers, provided there is an efficient water supply. Glazed earthenware pipes, having properly-constructed junctions with man-holes where they connect with the main sewer, and similar man-holes where large branches connect one with another, are the most satisfactory way of dealing with the sewerage of a school. Six-inch pipes are the smallest size allowed by some local authorities, who do not realize the advantages of a smaller diameter. The larger they are, the less likely are they to be self-cleansing. All sewers ought to cleanse themselves by use. The greatest danger in a school system is the disuse under which they suffer during the holidays.

Sewers should be flushed after every recess.

It ought to be a rule, that the sewers be thoroughly flushed down and fairly tested at the end of every recess, the day before the school re-opens. If this rule was adopted, many epidemics, which now arise in schools from impeded sewers, would be prevented. The cause of stoppage has been the drying of the sewer when it has been out of use—deposit adheres to the pipes. When it again comes into operation, there is interference with current, increased deposits are sure to take place, and sooner or later entire stoppage. There is then a flood of sewage in the neighbourhood of the schoolhouse. This would never occur if the sewers were examined as a matter of course at the commencement of every term. So, also, when sewers are newly laid they ought to be tested before the buildings are occupied. First, to see that the joints are not leaky, and secondly, to see that there is no impediment left in the pipe by careless workmen. To sum up the requirements of house drains in as few words as possible, we have these facts:—

Requirements as to sewers.

1. The drain pipes must be made of impervious material.

2. They must be perfectly jointed so as not to leak.

3. They must be perfectly smooth internally.

4. Their diameters must be the smallest that can be used.

5. The gradient not less than one in fifty.

6. They must be laid upon a solid bed of concrete. Before being covered over, and after the cementing material has dried, they should be carefully tested by filling them with water and exposing them to a certain amount of pressure to prove their soundness.

7. They should then be covered with concrete.

8. There should be inspection chambers, capable of easy examination at frequent intervals, and at every junction.

9. When smaller pipes lose into larger ones, a tapering pipe should be used, not (as is usually done) a smaller directly fitted into a larger.

10. Larger sized drains should never discharge into smaller ones, that is, a six-inch into a four-inch pipe.

11. No drain in direct communication with a sewer should pass through the wall of a building.

12. But if a drain, having indirect communications, do pass through the wall, there should be no pressure upon the pipe, an arch being turned over it.

13. When syphons are used as traps, they should have a smaller diameter than that of the pipe itself.

14. There should be no direct communications between the interior of the house and the house drain; all waste pipes should discharge as indicated in fig. 8.

15. In laying house drains care must be made to avoid the roots of trees. When trees come in the way, there must be an extra layer of concrete around the pipe, both above and below, otherwise the roots, in due course, will lead to displacement and stoppage.

16. Sewer pipes should never be jointed with clay, cement only being used; and this must always be

surrounded with concrete, unless the pipe is being carried through a bed of actual clay.

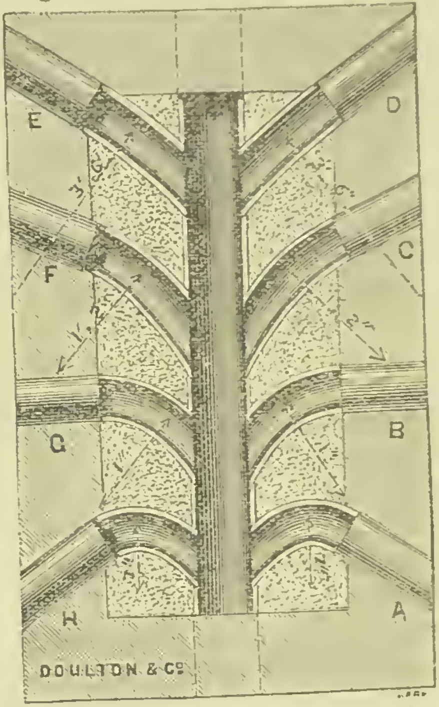


Fig. 8 shows a cavity 12 or 18 inches below the level of the ground. It is covered by a very perforated iron grating, and receives all the various kinds of waste from—

A, Rain-water.
B, Butler's pantry.
C, Housemaid's closet.
D and E, Soil pipes from water-closet.
F, Waste water from bath.
G, Waste from kitchen sink.
H, Rain-water pipe. The pipes are half cylinders only at exposed part. *N.B.*—Letters only refer to proposed positions, which may be varied according to plans of architect.

17. Drain pipes should never be laid inside a dwelling-house or school; if in closely packed towns

it becomes absolutely necessary to pass under the house to get to the sewer, the drain should be included in a thick bed of concrete or asphalte.

18. Every drain must be thoroughly ventilated, so that no stagnant air should remain in any part of its course.

VENTILATION OF HOUSE DRAINS.

Traps, to say the least of them, are broken reeds to lean upon, when alone trusted to, to keep products of sewage decomposition outside the house. In dry weather, the water, upon which their efficiency depends, evaporates, and at the very time when they might possibly be of service, viz. when putrefaction is taking place in consequence of the heat and dryness of the season, and foul gases are being evolved, the water which was in the trap has disappeared. Taken as a whole, a system of drainage which depends upon traps for its efficiency is a bad system. When sewers are dependent upon water-traps alone for protection against the invasion of sewer air, the protected buildings will sooner or later suffer for the confidence which has been placed in them. Sometimes, however, it is wise to choose the least of two evils, and to have a trap placed in some positions, notwithstanding its defects when it is employed as the only protector. Thus, when it is necessary for the rain-water pipe to discharge itself into a badly-laid sewer, the junction should be trapped. It is safer to trust to a trap at this point than to leave the rain-water pipe untrapped, or to make it loose upon a trapped grating at the level of the soil in the playground, that is, if the gully into which it discharges is connected with a closed sewer; if, however, it can be made to discharge upon a disconnected outside

Ventilate, don't trap.

opening, as in fig. 5, it is better still, but the trap in that air chamber must be protected by a ventilating pipe. Dipstone traps, as they are called, are very common arrangements in country districts, and country builders seem to put them in as a matter of course, and consider them marvels of perfection, but they are very objectionable, as seen in fig. 9, which exhibits the old dipstone trap, showing how refuse remains in the cells.

Gullies of a similar character should be prohibited in all plans for draining school buildings: any kind of arrangement which interferes with that grand canon law in all drainage work, viz. Motion, is wrong in principle, and should not be allowed, except under very special circumstances. There should be nothing in the sewerage arrangements of any school which can bring excreta to a standstill, and keep it for more than a very short time in the neighbourhood of the school buildings. Indeed, from the moment when it passes into the sewer until the moment when it is exposed to those influences which are requisite to alter its chemical form, it should be kept up to the motto which is supposed to belong to the policeman, viz. that of 'moving on.' The sewage should move down-

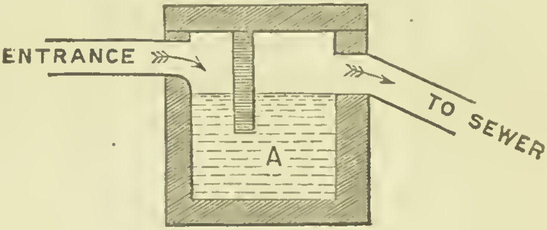


Fig. 9.—Old dipstone trap, always containing deposit at A in state of fermentation.

Nothing to be allowed to stagnate near a school.

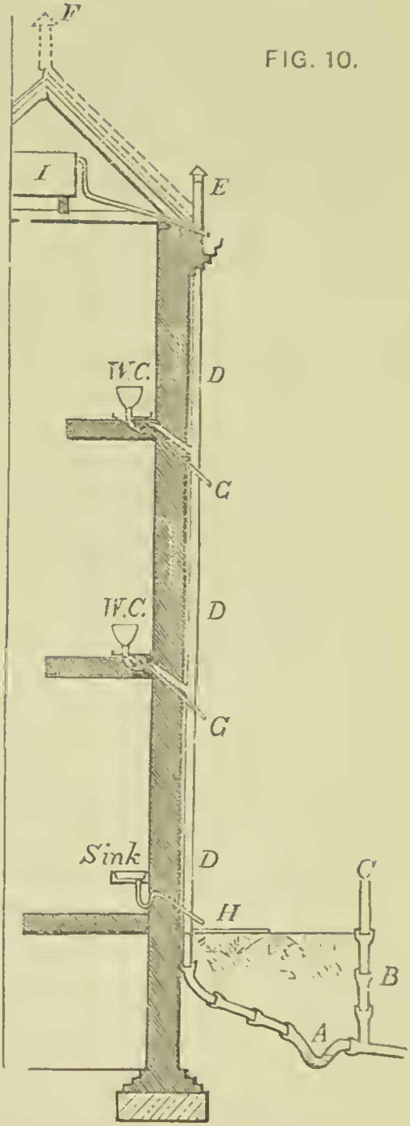
Policeman's motto of 'move on' the best.

ward until it is acted upon by some chemical reagent or comes into contact with growing vegetable life, by means of which the organic matter is seized upon and changed into a direction which is quite opposed to the possibility of the establishment of infectious disease. This class of diseases cannot be produced if one of the constituent parts necessary for its production be absent. Changes must take place in a particular direction, in the organic matter of sewage, to allow of the multiplication of disease-producing matter. That direction is associated with fermentative developments. These developments are arrested by chemicals which prevent putrefactive changes, and place the chemical atoms of the compound in a form in which germs of disease cannot grow. But they are more certainly prevented by vegetable life, because the cells upon which plants depend for their growth and development seize upon organic matter with which it comes into contact, and alter its constituent form; so that the fermentative change which is necessary for the increase of zymotic disease cannot take place at all in that matter. Hence, the most perfect preventive service which can possibly be employed against infectious disease is, to bring the matter upon which it depends for its growth and development into contact with vegetable life as soon as possible. The excreta of human beings and of flesh-eating animals are the matters which most certainly promote the spread of infectious disease. House sewage should be hurried away from human habitations and brought into contact with vegetable life at the earliest possible moment. Chemicals may destroy the excreta if used in sufficient quantity, but in too many instances they only act as preservers of dangerous matter. They arrest putrefaction, and

Prevents growth of disease germ.

Vegetation necessary for sewage, to prevent the mischief of decomposition.

FIG. 10.



A, Trap between main sewer and house.
B, Ventilator to protect trap extending up at C.

other allied changes; and in arresting these, they only postpone dangerous changes to some more remote period. This imperfect position cannot arise when vegetable life is the agent, for the organic matter is changed at once into harmless matter, and for ever prevented from giving rise to any kind of danger. Sewage, when once formed, is to be kept in motion until it is far away from any people who are likely to be affected by it, or is brought at once into immediate reach of the vegetable kingdom. It is in accordance with the law of motion that sewers and house drains require to be ventilated; whenever a trap is inserted in any part of a sewer system, there should be an opening communicating with the outer air close to the trap, and between it and the main sewer (see fig. 5). By this means air may be admitted freely into all parts of the sewer system, whether the drain pipes are above or below the level of the ground. No antagonism to this principle should be introduced into any part of the drainage of a school; so that neither air nor sewage may ever have the chance of becoming stagnant even in a short portion of a house drain.

Destroys disease germ.

Air must be admitted into drains.

The principle to be adopted is to have an opening communicating with the external air at every point at which there is a connection with a W.C., and also never to allow the end of a sewer or house drain to be a closed end. This plan is shown in fig 10, which

D, Ventilator for W.C., continued to

E, which is above the spouting, and

F, The ventilator is sometimes continued to F when there are windows above the rain-water gutters.

GG, Are openings for tell-tales put in to protect against overflow in W.C., they have no communication with sewer at all.

H, Level of ground outside the house, at which may be placed a grating similar to that in fig. 5, in which case fig. 5 may occupy the space below H. *N.B.*—Plan not drawn to scale.

is the principle I recommended to the Croydon Local Board in the year 1865, and to the Social Science Association two years afterwards, and is now adopted as one of the essentials of house drainage.

W.C.'s not ventilated, may be untrapped by use.

When the W.C. comes into use, if there be no ventilator, it is probable that the trap will be emptied by a syphon action, and will not be of use against the intrusion of sewer gases from the main drain, and such products will be introduced directly into the house. Even if the pressure is not sufficient to overcome the resistance of the water, the gases and their attendant germs will be absorbed by the water, and some of the results given off into the W.C., and thus brought into actual contact with those using the apparatus.

CLOSETS, URINALS, AND WATER SUPPLY.

The sewers in a given school must be modified according to the character of the district in which it is situated. The water supply of the place will have a considerable influence in determining the principles to be adopted. We must look at them, therefore, from three points of view:—

1. Those districts in which there are neither sewers nor public water supply;

2. Those in which there are both sewers and water supply; and

3. Those districts in which there is a system of sewers with which the school can communicate, but in which there is no public water supply.

Difficulties of schools without water supply and sewers.

Schools situated in districts without either public sewers or water supply have to contend with difficulties which do not belong to town schools. It may be assumed that the district is not a very crowded one, possibly not a very populous one; and if such is the case, it may also be assumed that the inhabitants generally are not very enlightened as to the evils attendant upon bad drainage, or of the entire want of it. It is the custom in the majority of country places to have a cesspool in some retired part of the grounds; it may be a lean-to, attached to the least observed side of the school buildings, or it may be situated in one corner of the playground, or even within the precincts of the school itself. All these plans are bad. Cesspools in playgrounds and near to a schoolhouse are full of danger, and are quite certain, sooner or later, to produce mischief to the children. They will play about the retired parts. When a child is in disgrace, or does not feel well, it will often loiter about the closet for various reasons, at a time when it is most liable to get mischief from the place itself; for disgrace as well as illness produces a depressed state of nerve-power. If there be no water supply, and if it is not possible to arrange for a continuous and abundant quantity, water-closets are not to be thought of; and yet cesspools should not be introduced except in exceptional cases, for the conditions allowing them are very rare. Earth-closets, such as those constructed by Moser or the Earth-Closet Company, should be employed. It must be the duty of some person to see that they are kept in a satisfactory state. The school superintendent should himself inspect them every day, and take care that the proper custodian does his duty. I prefer sawdust to earth for the purpose of charging the hoppers; it is cleaner. It is to be procured in every village by an arrangement with the sawyers of the district; and when it can be obtained from pine wood, the turpentine in it is itself a deodorizer. If mixed with dry earth, it effects its purpose still better. There is a difficulty with

Cesspools not permissible.

Earth-closets.

children, because they will play with the hopper—they like to see the action. This can only be obviated by the supervision of the teachers themselves, keeping a strict eye upon the children and frequently inspecting the places. This inspection should be made in the interests of the school. An inculcation of maxims connected with the observances of decency in these places will have a good effect upon the children in more ways than one, and is really an important part of their education, and any superintendent who fails in this duty is neglecting an important branch of a child's instruction.

Daily inspection necessary.

Urinals.

The urinal is always a trouble at school, in whichever class of district the school is placed. It requires to be kept very clean, and to be thoroughly washed down in warm weather every day, and even more frequently if there is infectious disease in the district. Slate is the best material of which to construct it. The floor should be impervious, and slate, York stone, or asphalte is to be preferred to such things as brick, wood, or any porous material. It should have a trapped grating communicating with a drain to carry off the water used for washing it down, the trap in the grating being protected by a ventilator, as shown in fig. 5. The duty of washing down should be done as naturally as that of sweeping the floor of the school, so that it shall not be possible for the trap to get out of order. A neglect of attention to this operation is certain sooner or later to bring mischief to the children. Enamelled iron is sometimes used for the apparatus, but it is liable to chip; the iron oxidizes, and then it does not keep clean. The slope of the floor should be in a direction away from the person and towards the urinal. The slope should be considerable. A slab inclined at an acute angle is frequently put in

Their construction.

front to contain water. These slabs are liable to produce nuisance. It is better to have a clear space, so that little boys as well as taller ones may use the place without making a nuisance. There should be a channel cut in the slate a few inches from the wall, about two inches in depth, in the floor of the urinal, and that, with a proper fall to the outfall or trap, will be sufficient. The trap should be outside the place, and out of the way of the boys. It is better for the urinal to be open to the air on all sides, partitions being put up for decency's sake, but so situated that air may blow through and around. If covered, it should be by a roof raised some distance from the walls. The upper part is better enclosed with lattice-work rather than in brick. The closed part should not be much more than breast-high, whilst the lower part should be latticed with brick for about a foot from the ground, so as to allow ventilation in the lower part of the urinal as well as the upper. This is generally neglected, but it is necessary. There are several forms of urinals patented by different makers; but patents are out of place in school premises, and the simpler the apparatus is, the longer it will remain without becoming a nuisance; and, as I have already remarked, a continual supervision and regular cleanliness is necessary for every kind of urinal and closet. I prefer this plan to any other. If there is a water supply provided, and water is allowed to trickle down from a pin-holed pipe, children will play with the streams and try to drink from the holes. Everything likely to detain children in these places should be interdicted. Personal inspection and frequent washing, by persons appointed to do it, are far better than the elaborate apparatus which is often provided for the purpose of avoiding

Ventilation necessary.

Simplicity necessary.

this duty. The most elaborate system requires about as much supervision as the simple one I advocate, whilst elaborate designs are also expensive and easily get wrong. Woodwork of all kinds should be kept out of the place, at least out of the reach of contamination. If York paving is employed, large slabs should be used, and the use of metal should be avoided except where absolutely necessary. Let me urge frequent inspection by the master, and the appointment of a monitor of closet among the boys themselves, who shall be responsible to the master for good behaviour. If the school is in a district with an abundant water supply, the mischief is lessened.

Water-closets. Water-closets or earth-closets must be arranged according to the numbers in the school. Places for five persons for each hundred should be provided in the case of day-schools, whilst for boarding-schools the number should be increased. The character of the closet must depend upon circumstances, water being used if there be a public supply. There ought to be eight provided for each hundred children in boarding schools, and girls require rather larger allowance than the boys, because in the case of the former urinals are not required. The arrangements provided by Moser in his form of closet meets a serious difficulty. There is a partition in the soil-pan which separates the solids from the liquids; and if these are properly looked after, they do admirably well, but, like everything else connected with sewerage arrangements, they require a continuous supervision. This closet gained the Silver Medal at the Exhibition of the Sanitary Institute, in 1880; but Moules', or Parker's, or that of the British Sanitary Company of Glasgow, will equally well serve the same purpose, and have all been approved by the judges of the Institute. If there

Earth-closets.

Nuisance inspector should visit regularly.

is a good nuisance inspector, as there ought to be in every district, it is wise to make an arrangement with that official to visit the premises frequently, and see that the instructions of the manager are carried out. As regards the soil which has been used in the closets, there ought not to be any difficulty in arranging with some neighbouring gardener to remove it, if the local authority fails in its duty; the gardener replacing the tub which has been used by an empty one. It is necessary to arrange that the visit for this purpose should be when the places are not likely to be in use. Early in the morning before the children are moving, or after school hours, is the best time for the purpose.

Water-closets should be out of doors.

Some authorities upon school hygiene suggest that children should not be expected to go out into the open air for natural purposes connected with the use of the closet or urinal. It may be wise sometimes to provide for a covered way from the classrooms to the W.C.'s, but I strongly object to closed passages, even when swing doors are provided. These passages are certain to convey foul air into the house, and the swing doors act directly as pumps for bringing it into the classrooms. Delicate children, who cannot bear the exposure which arises in passing from the school to the outbuilding, are much more likely to be injuriously affected by the foul air of a badly constructed closet than by the exposure which arises from going out of doors for such a purpose. Children who are brought up in properly ventilated schools, are not likely to receive damage from this exposure.

If there is a system of sewers into which the sewage of the school can pass, the most convenient form of drainage is by means of the water-closet. The vessel should always be constructed of earthenware, and those

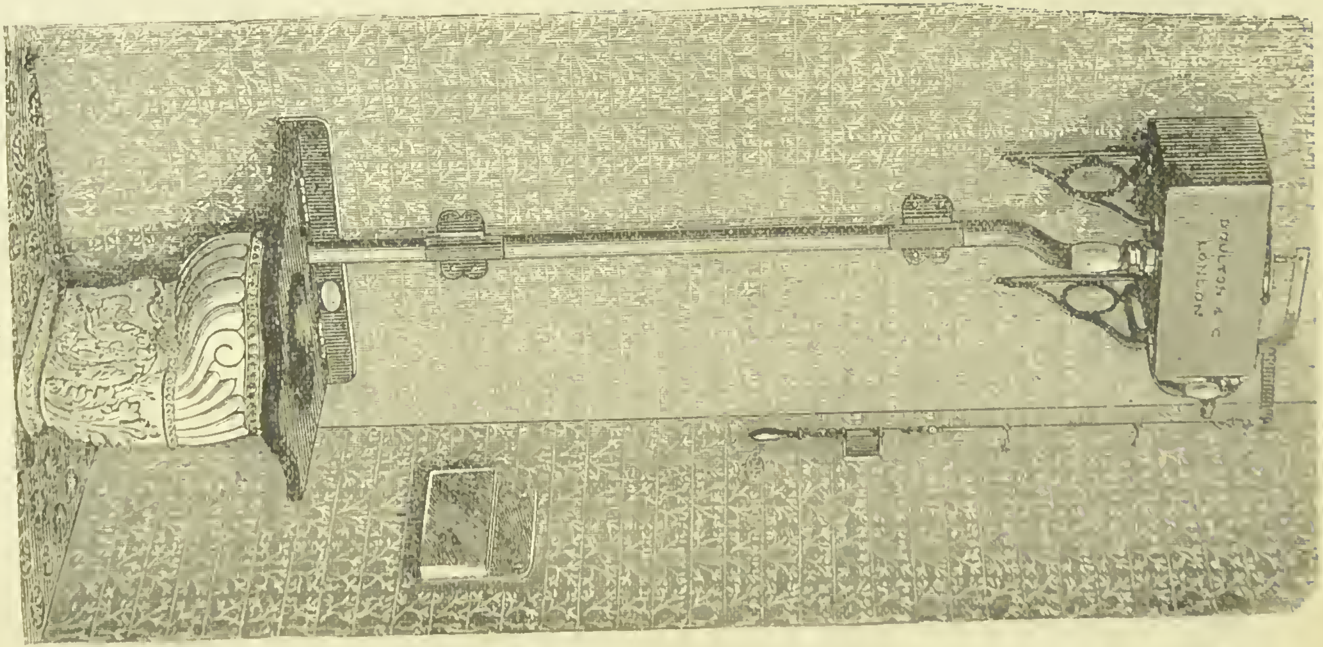


Fig. 11 is a more elaborate, and yet simple plan. There is a simple pedestal without enclosure to harbour mischief, and a water-waste preventive cistern which gives a rapid flush out. In some, the lid is made to lift up, and the basin becomes a urinal.

in which the flush of water is considerable, and which are without so-called containers, are best. The pan should be so fixed that the flush of water shall wash away the contents directly into the drain, and not drop them down into an abyss below, there to remain until another visitor comes to the place. In this latter form of closet, there is always foul air rising from the container every time the closet is used. There are several forms of closets which have been approved by the judges of the Sanitary Institute of Great Britain, such as Hayward, Tyler, & Co.'s Full Flush Valveless Closet, Jennings', Doulton's Lambeth Flush-out Closet, and various others, which may be seen in action at the Parkes Museum in Margaret Street, London. The soil pipe attached to each closet should be properly ventilated by a pipe equal in diameter to the soil pipe; this should pass directly upwards, and be open above the level of the school buildings (see fig. 10). This ventilator must be between the sewer and the trap of the closet. The forms of closets are very various.

Construction of closets.

I have mentioned the best kinds which can be adopted: the flush of water should be immediate and full, not a driblet, as is too often the case. Care should be taken that the fittings connected with the water supply are made of substantial iron, and so placed as not to become frozen in long frosts. If they run any risk from this source, they should be encased in felt, and an arrangement made either for keeping them empty at night, or for heating the iron so that freezing shall be impossible. In some large schools a kind of trough closet is provided, allowing of use by several together, and making one flushing operation for perhaps fifty visitors. It is flushed out at regular intervals by an attendant. I think the plan is a bad one, and only to be allowed under very special circumstances, such as want of means and want of water. Closets which flush themselves by an action caused by the weight of the user are advantageous when well constructed, but they are very liable to get out of order and lead to expense.

Frequent inspection.

Like to urinals, school closets require frequent inspection by a responsible attendant and a school monitor.

CHAPTER IV.

WATER SUPPLY.

THE requirements of a school as regards water will not be less than eight gallons per head per day for water-closet purposes. The greatest care must be taken that the water stored for the purpose of flushing the closets shall not be drunk by the children. An ample supply of water for drinking purposes should always be provided in every school, but it should not be taken from a cistern which is kept over a closet. Pure water is very absorbing, and the gases which naturally belong to a W.C. which is in frequent use are rapidly absorbed by the water. If this is drunk it may be a means for spreading disease. Water for drinking purposes should, if stored at all, be stored in a cistern which has no connection with the water-closet. There should be a water supply easy of access in every playground, and yet so placed as not to be capable of being made into a means of mischievous play. It should be inculcated as a moral duty by the school managers that water must be kept pure, and that to pollute the water, or to play with it, will be considered as a serious offence. If there is no public water supply, there will be much difficulty in meeting this want; but it is really important that children should be provided in some way or

Water supply necessary for children.

other with pure water, and that thus the risk should be diminished which arises from their being tempted to quench their thirst at some pond or road-side ditch. A school without a supply of water for drinking purposes fails in a part of its work. A thirsty child is not in the best condition to receive instruction, and a draught of pure water before going into school may make all the difference as regards the completion of the work, and between the exhibition of temper or of amiability. I urge all managers of schools to take care that a water supply is easy of access for the scholars, and that they have time and opportunity to take advantage of it. If possible let it be a constantly running fountain in the playground, and when this is not possible, there should be a pump to supply a proper cistern.

BATHS AND BATHING.

Swimming-bath necessary in large schools.

The subject of baths and bathing is intimately associated with that of water supply. Every large school should have a swimming-bath attached to it as a part of its establishment as an educational institution. If there is a stream of clean water in close proximity to the school, it may be possible for the managers to make such arrangements as may render the stream available for the purpose; but it is necessary that there shall be good supervision of the bathing-place, otherwise accidents are likely to happen, and the managers will not, in that case, be quite free from blame. They know that boys will always be boys, and that they will get into danger if they are not controlled by wiser heads, and that then occasionally there will be a death from drowning.

It is culpable negligence on the part of the managers not to provide against this possible contingency. It is their duty, by proper regulations, to prevent its occurrence. Schools containing several hundred boys will be incomplete unless they have a swimming-bath of their own, or one in some way open to them. There ought to be a standing rule in every school, that swimming should be as much a part of education as cricket or music; or even more so, because it may chance to any one to have his own life, or that of a fellow-creature, lost for want of this knowledge on his part; whilst such loss could not arise for want of acquaintance with the rules of cricket or football. Managers of all schools should therefore look out for bathing-places in safe situations, and make proper arrangements for their supervision, if they cannot provide a private bath upon their own premises. If there is a public swimming-bath in the district, they should negotiate with the managers of the bath for the periodical admission of their scholars to its advantages, and if this cannot be done on satisfactory terms, they should establish a swimming-bath under their own management. Those who happen to be acquainted with the pauper establishment at Anerley, may easily know the good results which follow from the rule at that school, which makes every boy learn to swim before he finally leaves its roof. There would be an advantage in the same rule being applied to girls. That which a pauper school does, cannot be very difficult for elementary schools to do, and there can be no difficulty in the way of private adventure schools doing it when there is a river or a public water supply within reach. There are some districts where it will be impossible from the absence of sufficient water, but it is very exceptional, as it need not apply to any place having a rainfall of twenty-five to thirty inches per annum.

Bathing must be part of school work.

It will generally be easy to secure a basin, into which rain-water may be diverted, which will serve the purpose; whilst, if there be a water company, water may always be obtained. If the bath be properly placed, the water could afterwards be used by the local authorities as a means for flushing the public sewers at regular intervals; and, if used by elementary schools, it ought to be possible for a mutual arrangement to be made, by means of which the cost should be small to the school authorities, and not be any additional charge upon the ratepayer. School education, either public or private, is not complete, which does not teach children that a clean skin is a necessity, independently of the advantage of being at home in the water. If all children were washed all over the body, only once a week, it would tend to diminish the incidence of infectious disease generally, and also to prevent some of that unpleasant odour which too often belongs to the atmosphere of a schoolroom when full of pupils. I recommend all school authorities to encourage bathing as much as possible every day in hot weather, and at least once a week in cold; let it take its place in the drill of the school. and be considered a part of the education of the child—attendance at the bath counting in the time-table. It will encourage an exercise which is important as regards the health of the children, whilst it will give confidence to them when in danger. and make them better citizens when they have come to years of discretion. A knowledge of this accomplishment will help to train a child. A boy that can swim is worth much more in everyday life than a boy who cannot. A child who has been accustomed to plunge into cold water will be much less likely to suffer from sudden alteration of temperature than one who is

Water of bath to be used to flush public sewers.

never washed in this way; whilst if by chance he should get wet through by a sudden storm, he will be less likely to be chilled, or laid up by fever. Cold bathing is also much more advantageous than warm baths; there is considerable danger from the too frequent application of the latter, as the following incident will show.

Cold water preferable to hot.

Hot baths lead to croup.

A number of medical men were, some years ago, assembled together at Edinburgh, when a remark was made that croup seemed to be occasionally epidemic in the winter months. On comparing notes, it was made out that Saturday night was the usual time at which it occurred; a few further inquiries showed that tubbing-night provoked the attacks, and that there were dangers even in cleanliness.

Hot baths in a steaming atmosphere in cold seasons of the year are likely to do damage to sensitive temperaments. I will give another illustration.

Bronchitis

Delicacy of constitution.

Two large families lived next door to each other in precisely similar conditions. It was found, on comparing notes, that at one house the doctor (myself) was frequently in attendance for croup or bronchitis, or some other malady, whilst in the other case his visits were infrequent. I advised that the reason consisted in the hot baths with which the children were treated every morning by a self-willed nurse in the one case, whilst in the other the children were daily accustomed to a cold dip. The washing with warm water was given up in the delicate family with rapidly manifest advantage to them, and a serious diminution of the fees which I was accustomed to receive from the family. It was not long before the one family became nearly as healthy as the other; but it was years before the delicacy which the hot bath induced could be entirely, if ever, eradicated.

Warm water is pleasant to wash with, but it is not advantageous for children habitually to use it in cold climates. No bath should be habitually used by those in health in cold weather which is above sixty degrees in temperature.

Bathers to go at once into the water.

It is not advisable for children when going to bathe to chill themselves whilst undressing. This latter operation must be performed as rapidly as possible. The child should pass into the water as soon as he is undressed, and not remain in too long. First immersions should be for a few minutes only, the time being increased as the child becomes more accustomed to it; but cold bathing should not be begun in cold weather. He must be instructed to scrub himself dry with a rough towel, and not to dress until this drying, especially of the feet, has been thoroughly effected. The early morning is the best time for a bath; but if this be inconvenient, it should be between meals, and not when the stomach has been recently filled. Children should not be allowed to bathe immediately after a meal. The time for bathing should not be taken from their recreation, but should come into and be a part of school-work, and be always superintended by a master. It will be found that this will be an advantage in elementary schools, in the fact that the children's hair will be washed at regular intervals by this plan; and it will be advisable also for them to be instructed to keep the hair cut short, so as to enable it to be dried more quickly. Attention to drying the hair should be a part of the drill, and boys who have returned to study with wet heads should be sent out to dry them by a good rubbing.

Bathing just after meals not to be allowed.

Hot baths should be provided in boarding schools.

Day-schools cannot be expected to provide hot baths, but no boarding-school is properly furnished which is not supplied with a series of baths for washing purposes, and for use in cases of sudden illness. If there is no swimming-bath, it is easy to have a common bath with cold water, so that a cold douche can always be had. Hot baths are advantageous in those great schools in which boys are liable to be exposed to sudden immersions in cold water, as when rowing, and after football, in cold and wet seasons, when they become covered with mud. The hot bath may save them from bad consequences, provided they have a cold douche immediately on coming out of it. The hot bath then refreshes the system, and no harm is likely to be effected by the relaxed condition which a hot bath leaves when the cold douche is not used. When a man or a boy has a hot bath whilst in health, he should always use the cold douche before drying himself, and then his hot bath will do him no harm, but really refresh him.

With cold douche immediately afterwards.

The baths should be so situated as to allow of the water, which has been used for washing purposes, being also used for flushing the drains. For this purpose it is requisite that the waste pipe from the bath should be equal in diameter to that of the drain which is to be flushed, or else for the drain to be fitted in some part of its course with a penstock, which can be put down and kept *in situ* until the drain is quite full of water. If, then, the penstock be raised, there is a full flush, and the whole calibre of the pipe is properly washed out. Flushing, as ordinarily carried on, as against some of the dangers of sewers, is all but useless. Certain forms of developments take place on the upper sides of sewers which allow of fungoid growths. It is possible that some of these growths are intimately related to the production of germs capable of setting up morbid results when inhaled by certain sensitive temperaments. I have published some facts bearing upon this point of view in St. Thomas' Hospital reports for the year 1882. In that article it is shown how the effluvia from a certain ventilator in the public road, under certain circumstances, always produced a particular effect upon the mucous membrane of the throat, producing cough, and sometimes setting up the feverishness which goes by the name of 'catarrhal.' Flushing, to be really effective, must sweep the roof as well as the floor of the sewer, and by that means empty out the sediment which may be at the bottom of the drain; and also the bacteria, the spirillæ, and the vibrios which occupy the roof, and with these remove the foul air which fills the calibre of the sewer. These operations can only be effected by means of a proper supply of water. It is, however, waste to use water for such a purpose which has not been used for some other, and that other purpose is naturally for human washing. The waste water of baths in all large schools should therefore be intimately connected with its kindred work, viz. flushing the sewers; and for this purpose the bath should always be placed at the highest point on the school premises, so as to command every part of the drain, and to be capable of being discharged so as to fill its whole calibre. I must here give a caution as to the continuous introduction of hot water into sewers. This is a great, and at present almost unsuspected, source of danger. It is well known that certain diseases are only rampant when temperature continues above a certain point for a certain time. Thus yellow fever cannot get a footing in this country unless temperature has continued some time above seventy-five degrees Fahr. If sewers are kept at or above that temperature continuously by the discharge

Why and how public sewers should be flushed.

Hot water dangerous in sewers.

of hot water into them, it may be possible for the germs of yellow fever to find a resting-place, if they should perchance be introduced there. By analogy, it is possible that other diseases may be cultivated by raising the temperature of sewers. It is important, therefore, in the interest of the public health, that they should be kept as cool as possible. It is wrong to allow of the continuous discharge of hot water from any source to be finding its way into sewers, and day after day keeping up the heat of those covered ways. I believe that it is possible for diphtheria and scarlatina to be cultivated in this manner, and to be spread abroad occasionally when there are concentrated discharges of sewer air, and that germs of those diseases would be dwarfed or destroyed if the sewers were kept cool. It is best for hot water to be well cooled before it is discharged into the drains. I have met with many instances of epidemics which could be explained on no other theory that I could make out, and which disappeared as soon as the discharges of hot water were discontinued.

Cold bath to be taken with care.

I must not leave the subject of bathing without mentioning that there are dangers in the cold bath when injudiciously used; that delicate children of a certain type are unable to bear it,—that they must be acclimatized to it by degrees. A child who is chilly after a bath, has been injured by it. A child who complains of feeling tired and seems to be suffering from a kind of malaise after bathing, must not be encouraged to remain in the water. This kind of case must be weeded out, so to speak, from the class, and should be gradually brought to bear the action of the bath by a judicious principle of arrangement as to time. A rose tree which has been kept in a hot-house will not bear a temperature of forty-five degrees at once, and yet a rose tree which will not bear that temperature cannot be a healthy plant. It is the duty of school authorities to bring up a healthy class of children. Those who cannot bear a cold dip, or cannot bear to be washed in cold water, are not healthy. Measures should be taken to get rid of this inability. Fresh air is one of the means, and custom another. Children who are never washed all over, assist to damage the air of the schoolroom as well as their own persons. The pores are blocked by *debris*, and if the *debris* scales off, it is the most efficient forcing-bed for the promulgation of infectious disease among other people; whilst, if it remains on, it helps to make its owner more susceptible to epidemic influences. Thus on all hands it is important that the subject of baths and bathing should not be lost sight of.

Range of temperature.

The range of temperature for a cold bath should be from forty-five degrees in cold weather, to seventy-five degrees in summer. It is unwise to bathe in water colder than forty-five degrees. When it is below that degree, sponging the body in the bedroom quickly all over is the better plan. It is also dangerous to take a hot bath which is hotter than blood heat (98·5), unless with medical advice. Children who are washed every day with cold water, and who take a proper amount of exercise, will never really require a hot bath, provided the drying process is accompanied by a thoroughly good scrubbing.

Hot baths.

The best kind of hot water baths are those which are made in one piece of earthenware, being made of fire-clay, with carefully rounded angles and corners. They clean easily, and there is no lodgment for soap or dirt of any kind, and for this reason they are specially fitted for hospitals, sick-houses, and schools. The character of the fittings will depend upon the finances at command, but there must always be a waste overflow which must not discharge into the sewer, but into a hopper outside the house (see figs. 6 and 8), and from thence be conveyed into the sewer. Very frequently a so-called *safe* is fitted under the bath. This is a tray of lead to catch drip or chance overflow, and it is often a source of danger, for the waste from it is thought of no consequence, and is left in direct communication with the sewer. It must not do so, any more than the overflow of the bath or the waste pipe itself; all these communications with the sewer must be indirect only (see figs. 5, 6, and 8).

Their construction.

A bath should always empty itself rapidly, the waste pipe should never be less than two inches in diameter, covered with a proper metal grating to keep out soap, brushes, etc., from the waste pipe. It should be always larger than the supply pipes for hot and cold water combined. The supply should always be delivered at the top of the bath, and not, as is frequently done, at the same opening as that by which the waste is let out. It is impossible to prevent the return of some dirty water in the latter case. This returns into the bath when the supply is turned on, and with it comes epidermis scales and soapy matters, which show the disadvantage of the plan.

It is always right to have moveable baths, which can be taken into a bedroom in case of emergency, but these may be the ordinary enamelled and painted baths which are to be found in every furnishing ironmonger's shop.

CHAPTER V.

CONSTRUCTION OF THE BUILDINGS.

THIS part of the subject divides itself into several heads, connected with the nature of the foundation, the condition of the walls, the character of the floor, the capacity of the rooms, method of lighting, etc. Intimately associated with it is also the best course for ventilation and warming, whilst the adjuncts which are required in a school, such as cloak and hat rooms and washing-places, must not be lost sight of.

Requirements.

We have shown that the position of the bath and washing-places generally shall be such as may enable the waste water to be used for the purpose of flushing the sewers. It will be best for the urinals and W.C.'s to be so situated as to be capable of frequent flushing, where a copious supply of water is available. These latter portions of the establishment should never be a part of the building, but placed *in annexes* rather than as parts of the principal fabric. It is requisite also to keep in mind the recommendation that no sewer shall, under any pretence whatever, be carried directly within or under the building; also that the subsoil water should not be capable of changing its level very easily, for reasons already pointed out.

A damp course to be placed in walls.

The walls of the schoolhouse should be protected by what is usually styled a damp course, such as slate or other impervious material, imbedded in asphalte or cement, so as to effectually prevent the rise of water in the walls, whenever there is any chance of the invasion from below or without; a layer of sheet-lead is sometimes inserted. For the same reason it is very requisite for the rain-water to be carried off by proper spouting, and the outside walls not too exposed to driving rain, otherwise, the bricks becoming very wet, the water cannot sink into the ground, and has to evaporate into the school or outside, and thus increase the coldness of the whole building. It is always best to keep a fair space on the outside of the building well paved or asphalted, so as to prevent any soakage from rain from below. The floor of the schoolroom should always have a basement beneath it, which must be thoroughly ventilated, unless it is laid with wooden bricks as described below. This basement should have an asphalted or concreted floor. The space may be used for stores, but never as a playground or living-room for any of the attendants, unless it is above the level of the surrounding soil. It may be useful for warming and ventilation purposes. The floor of the schoolroom should be constructed of narrow planks of close-grained wood, such as pitch-pine or oak, with dovetailed or matched joints, so that none of those interstices (too often seen in floors) can exist, in which, when they are present, all manner of abominations may be retained. A still better plan is to pave the floor with blocks of wood set in asphalte, on what is called the acme principle. It is to be seen on the floor of Parkes' Museum, according to the plan now adopted in many schools. The blocks being cut in short pieces two inches thick, and laid herring-bone fashion. They are more expensive than an ordinary floor, but they are

Spouting required.

Nature of floor.

warmer, and especially are they noiseless, and comparatively much more lasting. It can be planed down when it wears, and is a wonderful comfort to the master; besides at once putting a stop to the possibility of collection of evil in the chinks, which are sure to form in an ordinary laid floor, when the wood gets old and thoroughly dry.

It is very important that all new floors be laid with well-seasoned wood. The floor should be well oiled or soaked with paraffin in every recess. I do not think it right to use asphalte or concrete, or to have stone or brick floors in the schoolroom. Wood being a bad heat conductor, is warmer and more equal in its temperature: if well laid with hardwood, the floor is easily kept clean. The walls should be perfectly impervious, so as not to allow of the absorption of the foul air which naturally attaches to a crowded assembly. If ordinary brick or limestone is alone available, the walls should be cemented in every part with hard cement. In those parts of the country in which impervious bricks, polished or glazed, or of ironstone, can be procured, I prefer to leave the walls uncovered; they may be finished, if laid in hard cement, without plaster or paint or paper of any kind: this diminishes the annual cost for repairs and maintenance, and looks very well, especially if the walls are picked out with bricks of different colours. There is an immediate disadvantage in this kind of wall, because it requires much greater care in ventilation than a pervious wall does, and the bad consequences of defective ventilation show themselves more immediately; but if more immediate, they are also more temporary, for efficient ventilation at once gets rid of the *materies morbi.* Not so in the case of buildings having porous walls; for a short time the lime con-

Impervious walls require more perfect ventilation.

tained in their very composition is a safety from the consequence of overcrowding. But after a time this safeguard is overtaken, and the lime does not act as such. Then the walls gradually saturate with animal matter, and in the end the building itself becomes a very focus of disease. Impervious walls shut out much of that continuous and imperceptible ventilation which makes old brick and plaster buildings healthier than more modern and less pervious places when these latter are badly ventilated; but there is a limit, and there is danger that the porosity of the walls may be overtaken. This kind of porosity is shown in dirty so-called smoke-dried rooms. The rafters are mapped out on the ceiling by cleaner lines than in the spaces between the rafters. These cleaner lines arise from the fact that ventilation is impeded on the line of the rafter, air passing through the plaster is filtered from its smoke and other organic matters, which remain attached to the surface of the plaster; fortunately, the carbon is a disinfectant and destroys the ammoniacal compounds which are to be found in the air of this class of rooms, otherwise they would be pest-houses, and spread infectious diseases in a most alarming manner. Whenever a ceiling shows this condition of things, it gives evidence of impure air: there is a necessity for fresh liming; but more than that, there is a necessity for a better ventilation, so that fresh air may get in and foul air get out in a more satisfactory manner than through pervious walls of mortar or brick.

Smoke-dried ceilings evidence of ventilation in wrong places.

Cornices, string-courses, and projections of every kind upon which dust can gather should be ruthlessly prohibited on the walls, or in any part of the room. The tops of doors and windows should be levelled off, and indeed all kinds of irregularities taken away,

Schools not to have ledges.

even raised thresholds should be avoided: everything which will interfere with a clean sweep is wrong. Granite and other stone of the Cambrian series are not good stones for building schoolhouses, unless they are very thoroughly ventilated; brick is far preferable when properly finished in the interior. I am rather an admirer of Mr. Lascelles' principle for house construction. His buildings are fire-proof and damp-proof; they are impervious to air and water, and artistic in appearance, whilst they provide a market for that which is now scarcely marketable, viz. the refuse of ash-pits. The impervious slabs which he manufactures make the best possible materials for school-walls. I have reason to believe that the buildings created by his method will be found to be less liable to some forms of infectious diseases, such as scarlatina and diphtheria, than any other. He has built a considerable number of cottages in this neighbourhood; they are very healthy buildings. The material itself is most excellent and durable as floors for passages and places not intended for living in; but I prefer wood for the floors of schoolrooms and living-rooms, even to Mr. Lascelles' slabs, excellent as they are for wall and ceiling purposes. The walls being well-finished brick-work picked out in different colours, or cemented, require neither paint nor paper. The wood-work where visible should be varnished or stained, not painted, and a well match-boarded ceiling with stained wood looks as well as anything. If the ceiling is not wooden it should be capable of being limed. It should be well provided with openings for free ventilation, as will be explained when that subject is considered.

The method of lighting is one to be considered, and construction cannot be finished in a proper manner if the course to be pursued is taken no account of. The windows should be capable of opening either as sashes let down from the top and raised from the bottom,—this is the best way, as it creates circulation,—or they may open as louvres, sideways. The top of the window-sash must be very near to the top of the ceiling, otherwise a portion is left in which the air of the room may be comparatively stagnant. The windows should be so placed that the light of the sun may shine into every part of the room during some part of the year; but this part of the subject must be considered more in detail with that of warming the building.

Windows to open both at top and bottom.

CHAPTER VI.

VENTILATION.

ONE of the most important subjects connected with health at school is that which deals with overcrowding. '*Too many children in the school*,' is the impression which is upon the mind of every lover of fresh air as soon as he sets foot in a school, the pupils of which have been assembled for an hour or two, and have remained in the room all the time. I seldom go into any school in the middle of working-time, especially in cold weather, without being struck with the fact that the air is too impure for perfect health. The impurity arises from overcrowding connected with a want of ventilation. These two subjects are mixed up very much together; one school with a hundred boys or girls in it may have a much purer air than another of the same size with only fifty, because in the one case the products of respiration are rapidly removed, and in the other in a great measure retained. The question of floor space is an important one, but not nearly so important as that of ventilation. If the air could be fairly and properly renewed, children might be crowded together, even more than the Privy Council allows in elementary schools, which was eighty cubit feet for each child in average attendance, or eight square feet of floor

Overcrowding and want of ventilation.

Cubic space and floor space useless without ventilation.

space; but as schools are generally conducted, this is really much below the requirements of healthy school life. Cubic as well as floor space is a delusion in various ways; one room ten feet high will ventilate better than another fifteen or even twenty, because in the one case the windows are carried up to the ceiling, and in the other there is seven or eight feet of wall between the top of the window and the ceiling itself. Cubic space is all but useless as a guide to the managers. The age of the children will be a factor in the case, though not so great as is often represented; for a child of six or seven requires nearly as much fresh air as one double that age. There are very few schools in which ventilation is so well provided that the regulation area can be kept without sometimes being a contributory cause of mischief, at the same time the great increase of expense which arises from any large addition to the floor space is an argument in favour of efficient ventilation.

This is generally said to be provided, and in theory it may be, but in practice, if it is properly weighed in the balance, it is found wanting when most necessary.[1]

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[1] The directions given by the Committee of Council on Education tend to minimize the evils of overcrowding, but do not remove them. They point out very satisfactorily that the number of children which a room can accommodate depends not merely upon its area, but also its shape and the positions of its doors and its fireplaces. They recommend that an allowance of eighteen inches be given at each desk for the junior classes, and twenty-two inches for the seniors, and each group of desks separated from its neighbour by an alley of eighteen inches in width, with general directions as to doors and fireplaces, and the desks not more than three rows deep on each side of the room. The width being from sixteen to twenty feet. But if these recommendations are faithfully observed, they will not obviate the evil of foul air, unless the most careful attention is directed to the continuous ventilation of the apartment.

It will be right that I should give the reasons for ventilation, and show that the floor space can only be kept down by providing for the continuous removal of the effete products which arise from the simple act of living. A pure air consists, on the average, of oxygen, 20·9; nitrogen, 78·95; carbon anhydride, ·04; some aqueous vapour with traces of nitric acid, ammonia, and other hydrogen gases, which make up the total in 100 parts of atmospheric air. The CO_2 is the principal impurity, and it is easily capable of detection. In crowded rooms it will also by its increase be a mark of the amount of albumenoid ammonia which will be found; this excretion is exhaled with the CO_2 from the pulmonary membrane and skin. There is also another contingency of some consequence, viz. if the CO_2 is increased, there will be a corresponding decrease of oxygen. If the CO_2, which is naturally not more than 400 parts in a million, be increased to 600, the oxygen will be decreased in a corresponding ratio; it is not a large amount, but it may make all the difference between health and disease, just as the addition or subtraction of half a degree may make the difference between ice and water. The air of great cities like London does not vary much in this matter, even if compared with the purest country places, Dr. Angus Smith tells us that 'Nature never seems to offer us air with even the loss of 1000 parts of oxygen in a million, comparing healthy places with unhealthy' (*vide* Air and Rain). The difference is the same as for CO_2, but in the opposite direction, viz. about 200 parts per million, and this (says Dr. Angus Smith) indicates a similar difference of vital principle in the air.

Composition of air.

The object of ventilation is to carry away the used-up air with its impurities of carbon anhydride,

Object of ventilation.

albumenoid ammonia, minute particles of epithelium from the skin and other disagreeable sources, with aqueous vapour from the breath, and to bring in the requisite quantity of oxygen. It is almost impossible to get in a supply of ozone, except in very thinly-peopled districts, and in those places which are not exposed to the influence of great cities. Its absence is a proof of adulteration of the atmosphere by impurity; but we are at present too ignorant of its actual influence to write about it in a dogmatic manner. It is not the presence or absence of the minute fraction of CO_2—often less than ·1 per 1000 parts—which makes all the difference between a pure or an impure air, but it is also the concomitants of that fraction. It is possible that the power of oxygen to pervade the tissues, to enter the circulation by endosmosis, and to give out CO_2 by exosmosis, is interfered with by the smallest possible alteration in the quantities of the atmospheric constituents, whilst the materials exhaled are undoubtedly poisons to the human frame. But whilst the increase or decrease of the CO_2 is of no absolute consequence, its presence, when caused by the respiration of flesh-eating animals, is a mark of the presence of more deleterious matter, which is not so easy of detection, but which is removed with the CO_2. The amount of CO_2 must be raised 250 times to reach the proportion of 1 per cent. An atmosphere which contains 1 per cent. of CO_2 gives headache; a candle is put out when placed in an air containing 2½ per cent., and 4 per cent. would be fatal to human beings. The average quantity of CO_2 exhaled by an adult in the course of an hour, whilst awake, is about 0·6 cubic feet; this quantity is increased by active work, and is influenced by diet, by age, weight, and sex.

Injurious effects of CO_2 and its companions.

Children exhale more than adults, weight for weight, and girls more than boys, and it diminishes during sleep; it is probable that we may assess their adulterating power at 0·40 cubic feet per hour for each individual. The problem before us is how to prevent the quantity of CO_2 rising from ·04 per cent. to something above ·06 per cent.; that is the best means for diminishing the organic matters and watery vapour which also accompanies the excess of CO_2, and return the air to its proper state of purity.

Overcrowding leads to poisoning one another.

It being a part of the necessity of school life that children should be brought into close proximity with each other, and as close packing rapidly deteriorates the atmosphere in which they live, there is a natural tendency in their assembling together to poison each other. It follows that some means must be taken to obviate this tendency, and to prevent a serious evil. We have not far to look for those means, because it will always be found in nature that the all-wise Author of our existence has placed the antidote not very far from the bane itself. The very circumstances which give rise to atmospheric deterioration at the same time set up conditions which provide a remedy if those conditions can have full play. There are natural laws which provide for the renewal of air in a given place, if those natural laws are not impeded by some contrivance of man's invention. The first result of overcrowding is to raise the temperature of the room in which the crowd is assembled. The natural heat of the body is about 98·5; and when a number of persons are in close proximity to each other, even in the open air, their heat is imparted to the air in contact with their persons; and if they are in a closed room, the temperature is rapidly raised to a figure which, if other natural laws did not interfere, would

Natural antidote.

Temperature raised by overcrowding.

raise it to 98·5, making it equal to that of the blood itself. But this tendency to equality is counteracted by a law regulating the diffusion of gases, and the tendency which exists between the air in the room and the air outside to equalize their temperatures, in consequence of a natural repulsion existing between particles of a gas of the same nature. There are also other attributes of matter provided by nature to prevent the annihilation of the human species, which would certainly result from natural causes if some such provision was not made. One of the first results of a rise of temperature in a given room is the establishment of draughts. Whenever the air of a room has its temperature made higher than that of the outside air, by any cause whatever, there is an increase in the size of the molecules of the air which expels some of the warmed air from the room. The same condition is established in air, as in water or iron or anything else under the influence of heat; each molecule expands and occupies more space than it did before. There is a tendency for the air in the room to diminish in material quantity by expansion in every direction. This causes a passage of air to take place from within outwards, and a commencement of the removal of the now adulterated air. But if air does get out, it follows, as a natural consequence, that air can also get in; and as the air outside is now colder than the air in the room, the cold air coming into contact with the warmer molecules causes them at once to contract, and to decrease in size; more cold air gets in, and a draught is set up. This cold air has an increased impetus, and the colder it is, the more certainly will it penetrate into the room with greater or less rapidity. The new intruders become warmed,

Draughts are produced.

Warm air rushes out.

Cold air comes in.

and, expanding, press against those which resist their enlargement less decidedly; this is on the warm side. Thus hot air goes out in one place and cold air enters by another, and a more or less thorough draught is established. This is a part of the principle by means of which winds arise, and the air is renewed on the surface of the earth. I stated that the problem was how to prevent the quantity of CO_2 in a given confined place from rising from the ordinary standard of ·4 parts in 1000 to some figure not much above that quantity. Nature gives us at once a means whereby this problem may be solved, viz. by admitting sufficient fresh air to keep the standard at its proper level; but this at once involves another problem which must be solved also, if the principle of ventilation is to be a satisfactory one. A man upon an average inhales 16·6 cubic feet of air per hour, and produces about 12 to 16 cubic feet of carbon anhydride in twenty-four hours. To keep down the level of impurity to its allowed quantity requires 100 times the volume of air for the purpose. It follows that more than 16·6 cubic feet of oxygen per hour must be supplied for the actual use of each individual for this object to be attained, and hence the tendency to excessive draught. To keep the air of a room at its proper standard will require the admission of about 3300 cubic feet for an adult male, about 3000 for an adult female, and at least 2000 for a child of ten years of age. If we take the requirements at 3600 cubic feet per hour, which is just 100 cubic metres, it gives the amount of air to be introduced as equal to one cubic foot per second for each adult male. This quantity will produce draught. How is draught to be obviated? This is the second problem.

16·6 cubic feet of air per hour is inhaled.

100 cubic metres per hour = 1 cubic foot per second.

How is draught to be prevented?

We must bear in mind that there are many other sources of CO_2 in the atmosphere of a room than from the human beings whom it may contain. There is the great consumption of oxygen, and the rapid formation of CO_2 in all cases in which lighting and heating are carried on by means of carbon or coal gas. Combustion may cause even a greater deterioration than that which is produced by human beings, although, from causes presently to be mentioned, it is not always so dangerous in its results. Besides fires and lights, there are numerous kinds of animals whose function it is to rapidly destroy the vital properties of oxygen; and there are also the thousand and one actions which are always going on in organic matter, by means of which still further quantities of oxygen are removed from the air, and to some extent returned as CO_2, in the oxidizing changes which are always taking place around us. These sources of vitiation must be counteracted. There is therefore an absolute necessity for the introduction of great quantities of air to remove the carbon anhydride as rapidly as it is formed. Dr. Parkes calculated that 2800 cubic feet of fresh air per hour are really required for each individual, and under certain circumstances, such as sickness or during the time when a low state of health is present, this quantity ought to be much increased. Take a room, therefore, which contains fifty persons. It is necessary to make provision for the introduction of nearly 150,000 cubic feet of air per hour to prevent contamination rising to too high a level. This introduction must also be equally diffused throughout the room, and not pass out again without conveying its proper quantity of CO_2 away with it. It will not do to imitate the action which is seen in the Lake of Geneva, where the muddy waters of the Rhone pass

2800 cubic feet per hour necessary.

right through without defiling the waters of the lake. Let the picture be reversed, and let the river be pure water and the lake muddy, and you have no advantage from the current, which passes away at the other end without taking the impurity with it. Such is too often the result of school ventilation which is carried out now-a-days; although, fortunately for humanity, there are qualities in air which do not so immediately belong to water. I mean the quality which resides in the law of diffusion of gases, by means of which the molecules of a gas have a tendency to repel each other and to diffuse themselves into space whenever the opportunity allows them to do so. It is this law of diffusion which leads gases of different densities, and with different attributes, to rapidly diffuse themselves even in opposition to the law of gravity. CO_2 is a very heavy gas, and has a natural tendency to remain at the bottom of a room, because of its greater density as compared with common air; but that great preserving power which the law of diffusion provides, leads to the rapid dispersion throughout the air of any quantities of CO_2 which may be discharged into space. Hence it happens that out-of-doors there is no great difference in the quantity of CO_2 at the top of a house as compared with the lowest level in the street, and the most thickly inhabited parts of a great city do not show out-of-doors any considerable diminution in the quantity of O, or of increase in the quantity of CO_2, a few parts in a million being the outside of this deterioration. The law of diffusion must therefore be a powerful means whereby the purity of the atmosphere is retained, provided the law has fair play. But, it will be said, if it is necessary to admit 150,000 cubic feet per hour into a room which contains fifty persons, how can this be done without

Law of diffusion of gases.

Acts in antagonism to density.

a draught being sent up? Here are the two problems: REMOVE IMPURITY, and PREVENT DRAUGHT. You have to take care that, in the first place, the temperature outside shall not be capable of interfering very much with your arrangements. If the season is temperate, provision must be made to admit fresh air so rapidly that there shall not be a difference between the inside of the room and the outside sufficient to set up currents in spite of the arrangements provided. If the temperature outside is cold, means must be taken to warm that cold air before it is admitted, and so prevent injury from that source. It will be seen from these observations, that a system of ventilation requires a series of entrances and exits which shall balance each other, and be capable of being regulated to meet the changes which arise from a rapid rise or fall of temperature, or from the increased or diminished number of human beings, and the increased or decreased amount of chemical change which combustion or other oxidizing causes may set up in a given room.

Two problems: —remove impurity and prevent draught.

Cold air must be warmed as admitted.

These observations will point out at once to the intelligent reader that no principle of ventilation can be provided which, without adaptation, will suit all conditions under which a schoolhouse, or any other place of assembly for people, may be placed. Those patents, which are so often vaunted as perfect ventilators, that are invariably without adjustment, are necessarily faulty; they may suit one set of conditions, but they cannot possibly do for another.

No system of ventilation applicable to every condition.

It is evident that if 150,000 cubic feet per hour are required for fifty persons, it will not be necessary to admit that quantity into that room if there are only five; for the rapid introduction and removal of air tends to chill the persons exposed to rapid removal, by carrying away some of their natural heat as well as the impurity which they produce; hence an intelligent regulation is necessary to be observed, and it is desirable that in every school there should always be an individual who knows something of the requirements of ventilation, who shall be appointed to regulate the inlets and outlets, to consult the thermometer, both in the room and outside, and under certain circumstances also to understand the theory of the dew-point, for reasons to be hereafter mentioned.

Impurities from breath and skin.

Respiration renders the expired air impure by the addition of other things besides CO_2: a variable quantity of organic matter is discharged from the lungs, and by transpiration from the skin, which amounts in an adult to from 30 to 40 grains in the twenty-four hours; children give out much larger quantities, weight for weight, than adults do. This organic matter consists of particles of skin, fatty particles, and (if there are diseased people in the room) particles of pus or matter, germs of fungi, bacteria, and other microphytes, and some volatile material, easily discovered by the fetid smell which it produces in any room closely packed and imperfectly ventilated. This smell is one of the most certain indications of overcrowding and want of ventilation. The air of a dormitory just before sunrise, in which there are too many children, and too little fresh air admitted, is sometimes very overpowering, as doctors too often find out, when, in cases of sudden illness, they have to pass from the pure air out-of-doors into the impure air of the bedroom. This organic matter, when collected by passing the air of such a room through water, which liquid easily retains it, very soon goes into putrefactive fermentation, and gives rise to an

Fetid smell from overcrowding.

excessively offensive product. Besides this organic matter, there is also a considerable quantity of aqueous vapour. If we take a glass of cold water suddenly into a crowded room, the outside of the glass will be immediately covered by a deposit of dew-like particles, and on a cold night the windows of a room which is crowded will be observed to be running down with water, condensed from the air inside the room by simple contact with the cold glass. This condensed vapour collects on walls, ceilings, glass, furniture, etc., making them feel damp and clammy, and setting up that peculiar and offensive odour which is the attribute of all ill-ventilated and over-crowded dwellings. To allow school children to live in an atmosphere of this kind is to condemn them to a low state of health, and to set up a strong tendency to the production of certain diseases. It enables the germs of infectious diseases to spread with great rapidity; and, even more serious still, it gives rise to the possibility of a tubercular diathesis being set up in a whole district. If there happens to be in such a place a person who is suffering from disintegrating tubercle (or that state which is called rapid consumption), or persons having discharges of a (so-called) scrofulous kind, the breath of those persons disperses particles of organic molecular matter throughout the room. If this matter is inhaled by another, that other being himself in a condition which allows the impure particle to find a nidus in his own body upon which it can increase and multiply, there is set up a focus from which it too often happens that so-called consumption is established, and permanent ill-health produced. I believe that persons in good health, and who are accustomed to live in pure air, are not likely to

Foul vapour condenses on cold surfaces.

Dangers.

become consumptive from this cause, and they may feel certain that to them consumption is not infective. Before particles of infective tubercular matter can take root in a given body and grow, it is necessary for that body to be the possessor of debased material which has not been properly excreted. If that debased material is not present, the germs of infectious matter which have been accidentally inhaled are perfectly harmless,—they can no more germinate than the grains of barley which are sometimes found in the tombs of the Egyptian kings can germinate in those tombs. Air, moisture, etc., are necessary for the germination of seeds; so impure and rapidly changing organic matter, such as that which is washed out of the air of a close room, and which has not been removed or oxidized, is the material in which the germs of infective tubercular matter can, and do, grow,—to the detriment of a whole district when a schoolmaster is afraid of fresh air, and keeps his pupils in an impure atmosphere.

Cubical content of room no guide alone.

These considerations show that the size of the room is not so important an element in the case as is the capacity for the entrance of pure air; and although the size of the room has an important bearing, and its cubical contents may be taken into consideration, it is not so important as the entrances and exits provided for the admission and discharge of air, and the floor space allowed to each child. The cubical contents may be much modified by the height of the walls: a room a yard square and fifty feet high would be no better for a child to live in than one a yard square and ten feet high. That illustration will serve to show the uncertainty which may belong to a consideration of numbers which are only based upon the cubical contents of a given room.

FLOOR SPACE, WARMING, AND LIGHTING.

Each adult destroys 16·6 feet of air per hour. 100 times that quantity per hour required to keep air pure.

The direct requirements for each individual adult being on the average 16·6 feet of atmospheric air per hour, and 100 times that quantity being necessary to prevent injurious pollution, the problem is, whilst removing the consequent impurity, how to avoid draught. It is easy enough when the numbers in a given space are few, the area large, and the temperature outside neither too hot nor too cold; provided the natural laws which belong to gases have fair play. But it is very difficult when persons are crowded together, and floor space is occupied to the utmost extent allowed by the educational authorities. I have said the direct requirements for an average adult is 16·6 feet per hour. Children do not require so much, tall people require more than short ones, men more than women. It has been the custom to consider two children under twelve years of age as equal to one adult, but there is no satisfactory ground for this calculation. I am inclined to think that as regards school children under fourteen it is better to assume that three may be counted as equal to two adults. Some experiments were made by the late Dr. Edward Smith, which, being checked by those of Valentin, seem to support my suggestion that three scholars should be considered as equal to two grown-up people, and that those above fourteen should rank as adults, because the vital actions which are being performed at and after that age are more active than in those who have become fully developed, and in consequence of that vital action the production of CO_2 and of breath exhalations is *pari passu* more abundant. Lofty rooms give more cubic space, but do not in the least help to keep the air pure. A space enclosed by four high

Three scholars equal to two adults.

walls, without roof and without inlets, would in a little time, if crowded with children to the extent allowed by authority, become exceedingly unwholesome. To enable me to illustrate our subject, it will be necessary to take a typical room, to fill it with children as full as the recognised authorities will allow, and then to determine what is to be done in the way of ventilation to keep the air pure. The Privy Council have ordered that no school shall obtain an annual grant which does not allow at least eighty feet of cubic space, or eight square feet of floor space, for each child in average attendance. This might be sufficient under certain circumstances in which lighting and warming were provided on the most advantageous conditions. It is, however, useless as a guide in matters of health, except to show what will *not* be allowed by the legal authority. A child's seat and desk cannot be accommodated with less than six square feet of floor space, if there is to be any possibility of the teacher moving about in the class. This, therefore, is the very closest proximity which is ever likely to arise: six square feet of floor space, or eighty feet of cubic contents, are the utmost limits allowed for crowding children into any school. It is far too crowded for healthy teaching under almost any circumstances, unless the air is kept in continuous motion at a rate of movement which even at ordinary temperatures would be unpleasant to both teacher and scholar. The warmth of the air in the room would prevent an injurious influence from the simple movement of air, to most of the scholars, but those sitting near the inlet would soon be chilled. At an ordinary temperature (55° to 60°) a rate of 1½ feet per second is not perceived: this is nearly 1 mile an hour; 3 feet per second is perceptible to most;

1½ feet per second = 1 mile per hour.

3½ feet is a slight draught; and 5 feet, which is rather more than 3 miles per hour, is a decided draught. Whenever the temperature within, as compared with that without, differs by 10°, there will be a draught; and this difference of temperature will soon arise in a school circumstanced as I have mentioned. This rate of ingress will begin in the typical case, which means for fifty children, a room 12 feet 6 inches high, 20 feet long by 15 broad. We will suppose the window space to be not less than one-fifth of the whole of the wall, which is the least it ought to occupy, and that the windows reach to the ceiling. If the temperature out-of-doors is not cold, the open windows will prevent the air being absolutely unwholesome to such a crowd in the room: for a short time, there will be no very serious injury, provided there are inlets for fresh air of a corresponding size. The air of the room may then be kept from becoming absolutely bad, but any diminution of exit will be followed by a rapid rise in the quantity of impurities in the room. It is almost impossible to prevent draughts when there is close packing; the result is that the window which is next to the teacher is closed as soon as there is a marked rise in the temperature of the room, for this rise is at once followed by draught. The teacher is the first to show that he feels this influence; the windows are closed one after the other, and presently the room becomes absolutely pestiferous. The personal feelings or antipathies of the teacher may be an active factor in the growth of tubercular disease in a given district. A full-blooded, sanguine man demands fresh air; the anæmic man, who really wants it most, will feel the draught, he will be distressed by the consequent loss of body heat, and will close the passage by which colder but fresh

Windows best for ventilation.

Window space should be at least one-fifth of wall space.

Difficulties of windows.

air is admitted. If open windows are to be trusted for purposes of ventilation, there must be a set of stringent rules regarding their closing, or rather, non-closing. It must be a positive obligation upon teachers not to allow temperature in the school or classroom to rise more than 10° F. above that which is outside in temperate seasons, and in colder weather never to allow the room to have a temperature above 60° F. There is nothing which so efficiently ventilates a large room as open windows, with a good fireplace, and a wide, open chimney; but the latter are out of use now in ordinary households, and besides, open fires are very unsatisfactory methods for warming a school or classroom, unless floor space is of no consequence, and fuel cheap, as in rural districts and the neighbourhood of coal fields. The measures for ventilating must be arranged with reference to the principle adopted for warming and lighting the school, and managers who neglect this rule will fail in at least two of the points mentioned, if not in all three. Open windows can be tolerated in hot weather, but they will not be endured in cold seasons. Hence it is necessary to take into consideration the principle which is to be adopted for warming the building when the plans for erecting schools are decided upon. It is customary to leave these questions to be settled after the school has been built. But, in reality, lighting and warming must be a part and parcel of the principle adopted for ventilating a school. Open fireplaces are unsatisfactory in large schoolrooms. Those children who are seated near to the fireplace are scorched, whilst those farthest away do not get a ray of warmth. Their places are fixed for them, and there is no probability of change, by which they may get into more comfortable

Wide, open chimney also required.

Ventilation, lighting, and warming mixed up together.

quarters. For reasons such as economy and efficient supervision, it is best not to increase the floor space to too large an area, but overcrowding greatly increases the difficulty as to ventilation, and the space permitted by the Privy Council is most unsatisfactory on the point of health. A school which is full, even in the ordinary meaning of the term, cannot be provided with air containing at all times less than ·6 per 1000 of Co_2 by any system of ventilation, unless in connection with artificial means for moving the air; unless the teacher is a sensible man, of a sanguine temperament, who does not mind open windows, and can bear the impress of colder air upon himself. An hour after assembly, the Co_2 will be found to have risen to 1 vol. per 1000, and, as a consequence, the children become heavy and listless, and unable to attend properly to the instructions of the teacher. The floor space for each pupil should not be less than nine feet, whatever the cubical contents of the room may happen to be; and this is too little unless the very best principles of ventilation are adopted. Twelve square feet of floor space will be more satisfactory. The windows may be used for outlets; they are very efficient, indeed, the best means that can be used for this purpose. They should be arranged so that warm air may always get out when the school is in work. They should only be used for inlets when the temperature of the air out-of-doors is above 50°. In cold seasons the air which is admitted should be warmed air, and warmed without depriving it of its vital principle. It should not be warmed by contact with flame or iron heated to redness. Air which has passed through heated flues—those kinds of heated flues which are sometimes provided—is impure air. It has been deprived of its beneficial properties before

Windows best for ventilation.

Ordinary closed stoves bad.

admission into the room, and is worse than even the admission of cold air would be. Cold air is preferable to the air which has been warmed in the usual way by red-hot iron or gas. Closed stoves and stove-pipes, unless they are properly constructed, are all bad means for warming purposes; and gas jets, when the products of combustion are not removed, are worse than all. The most dangerous forms of warming apparatus are those gas stoves which are supposed not to require any communication by stove-pipe with the outer air. Gas may be used for warming purposes, and, if the fittings be well designed, it will be found a most efficient means for warming a schoolroom; but then, all the products of combustion must be carried directly out of the room, and the warmed air which is admitted must not come (*vide* fig. 12) into contact with the gas flame. The best principle is a combination of Tobin's tubes, which shall enclose a set of (D) Bunsen's burners, these burners fitted to the bottom of the tube D, but able to obtain the air for their own purposes from the schoolroom. This air must be, after use, conveyed through a smaller tube (containing pieces of asbestos, or copper turnings), directly out of doors, H, and no part of it should find its way into the schoolroom. The copper or asbestos is for the purpose of retaining the heat to warm the air in the casing. The pipe conveying the products of combustion into the outer air should be enclosed in the Tobin's tube, which brings fresh air into the room from without, through the opening E; it warms that air on its progress up the tube. The warmed air may be diffused at all the corners or recesses in the room into which the pipes can be fitted—G. They should open in the room about three feet from the floor. These tubes should not be less than eight inches in diameter. The Bunsen burners must be arranged so that they cannot be tampered with. It

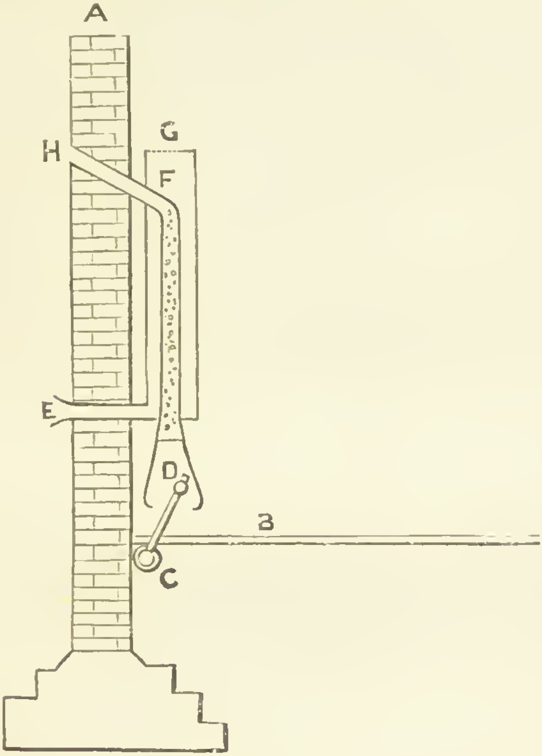


Fig. 12.

A, Wall of school.
B, Floor of school.
C, Gas supply-pipe.
D, Bunsen burners.
E, Opening for entrance of fresh air on outside of wall.
F, Tube containing gas-burner, and allowing warmed air to reach school at G.
H, Opening on outer wall for the escape of the products of combustion. (Not drawn to scale.)

may sometimes be convenient to have them fixed in the basement out of sight and reach (where there is a basement); but the air required for combustion is not then taken from the floor of the schoolroom, which is a disadvantage. Four sets of Bunsen burners (each set of which will consume four feet of gas per hour) will warm the air of a schoolroom sufficiently for 100 children, and 100 feet of gas per day is ample for the purpose, unless the winter is severe. The burners being lighted one hour before the children assemble, there need be no expense for coal, and if gas should be supplied, as it easily ought to be in most places, at 2s. 6d. or 3s. per 1000 feet, it will be a far cheaper and cleaner way of warming and ventilating a school or classroom than by fires, furnaces, chimneys, or water-pipes. The apparatus is simple, and if out of order can be easily put right by any gas-fitter. There should be inlets for fresh air of eight square inches super in the room, for each twenty children, and in close proximity to some of the inlets there ought to be a small pan containing a little water near to F. The warmed air in passing over this would take up the necessary moisture, and prevent the irritating effect which dried air has upon some mucous membranes. In severe frosts, the burners may be allowed to burn all night.

There are very few towns which do not possess a gas supply; but if there are no gas-works, then windows and open fireplace will be the usual method for warming and ventilating. It has been found by means of actual measurements, that only 12½ per cent. of the heat is utilized by an ordinary coal fire; but Captain Galton's ventilating fireplace utilizes about 38 per cent., and using only one-third the quantity of fuel. The usual plan of having iron to contain the fuel is false economy. The sides and back of the grate should always be made of fire-clay, and the recesses above should be splayed with fire-

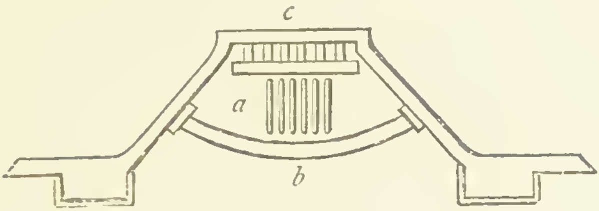


Fig. 13.

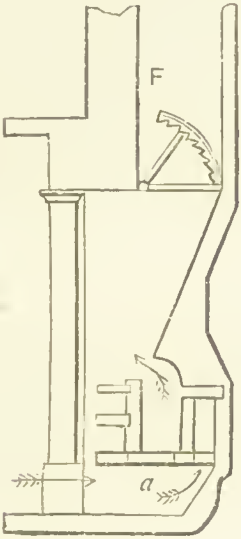


Fig. 14.

Fig. 13, after Galton's plan, shows front view of simple grate. *a* is fire-clay bottom, with a few openings for air; *b* are the bars; *c* indicates the openings by which air impinges upon the top of the incandescent coal; the air having been warmed in the back of the grate.

It is shown in section in Fig. 14. The arrows indicating the currents of air, and F being the flue for escape of products of combustion.

brick having glazed faces. Captain Galton's grate, recommended by the War Office, has a warm air-chamber behind the grate, obtaining its supply of air **Galton's stove.**

from outside. There is a communication between the air-chamber and the room, hot air passing out near to the ceiling or at other places. It is also the custom to check the combustion of the lower stratum of fuel by constructing the bottom of the fireplace of fire-clay. This leads to defective draught, but it saves fuel. The simplest and cheapest plan is to bring hot air on to the top of the burning fuel, and compel it to mix with the gases given off by the incandescent coal. This arrangement is shown in fig. 13. This allows air to penetrate to the fuel at the back of the grate, and keeps the coal in an active state of combustion, whilst the arrangement of the bars of the grate should be such as allow of the largest amount of radiation and the smallest ascent of hot air by conduction through the flue (F, fig. 14) as can be brought about, consistent with the absence of smoke. **Arnot's stove.** The oldest form of grate with solid floors was that of Arnot's. The fire is lighted at the top and burns downwards; the bottom of the chamber has to be raised as the coal is consumed. There is flame instead of smoke. **Edwards' stove.** The grate patented by Edwards & Sons is a considerable improvement upon this, but both are deficient in not applying hot air to the incandescent coal. There is some advantage in having small holes through the fire-bricks at the back of the grate, by means of which hot air can get direct to the burning coal. **Brown & Green's stove.** It was seen at the Smoke Abatement Competition that Messrs. Brown & Green's Smoke Prevention Grate had the best arrangements for direct under-feeding: fuel is placed on a curved ledge which projects from the bottom of the grate, and it is then forced beneath the burning fire by means of a shovel constructed specially for the purpose. The principle is to light at the top; to prevent loss of heat by fire-clay back and sides; to splay the sides so as to allow of as much radiation as possible into the room; to force fuel into the bottom of the grate so that the top of the fire, being kept in an incandescent state, may consume all the carbon and allow none to be lost by passing as smoke into the flues. In addition, in Galton's stove there is an air-chamber behind, in which the air is heated and passes by the ordinary laws of heat into the room; but it is not pure air, and sometimes irritates the air-passages of those breathing it because it is deprived of all its ozone and all its moisture.

Hopper stoves.

There is another class of stove in which a hopper is constructed at the back of the fire to hold a supply of coals. The fuel descends as it burns away, and passes into the fireplace by an opening in the bottom of the hopper. They do not give the homely appearance which belongs to the open grate, because the perforated curtain in front, though permitting the fire to be seen through, takes from its comfortable appearance; and it is necessary to get at the back of the grate to charge the hopper with coal.

Centre grate stoves.

There are also the 'centre grate' stoves, which are constructed in the centre of large rooms, such as hospital wards. The chimney passes under the floor. The fire is in an iron cradle fitted with fire-clay back and sides, these are pierced so as to allow a current of air to impinge upon the burning coal, the air having been heated in an air-chamber beneath the fireplace. The flue under the floor terminates in a vertical flue, which must be at least double the length of the horizontal flue, to allow of the production of draught; the angles when the flue turns downwards, as well as at the junction of the horizontal with the vertical flues, must be very carefully rounded, so as to diminish friction and allow of easy sweeping, which must be at the angle beneath the floor. These grates are extremely comfortable in rooms which are not crowded, like to hospital wards, but they are not satisfactory in schoolrooms.

I have not yet made mention of hot water for heating purposes. Hot-water pipes are costly; the apparatus is liable to go wrong at the most unfortunate period, and cannot be easily put right again; whilst there are other dangers attending its use, which make it unwise economy in schoolhouses, unless very well understood; and hot-air flues are even worse still. But there is a plan recently introduced by Wenham & Waters of Croydon, which removes some of the difficulty. That firm has adopted the plan I recommend for warming by gas: introducing fresh air from without in a similar manner to that shown at page 87, but it goes inside the hot-water pipe, and enters the room at the top of the coil, as in *a*, fig. 15. They are not unsightly, and a room of any size may be warmed most satisfactorily: the warmed air passing through the ring of hot water in the columns, and entering the room at any level at which the top of the radiating coils or stands may be placed. Though I like the appearance of an open fireplace,—we are so accustomed to its presence, that a room does not seem to be furnished without one,—I object to the dust which an ordinary fire produces, and, wherever possible, I would advise that the use of coal be discontinued, and Wenham & Waters' hot-water apparatus be introduced, or failing that, some form of gas be used, if gas is reasonable in price.—that is, not more than 2s. 6d. per 1000 feet. If it is too expensive to be used in this way, or the gas is not

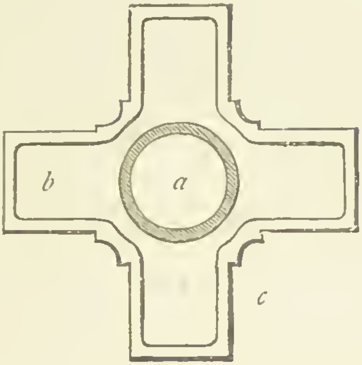


Fig. 15 shows a horizontal section through one of the columns in fig. 16. *a* is the interior of the pipe, communicating at its lower part with the outer air, and giving out warmed air at *a* in fig. 16. The hot water circulates in the pipe around the cylinder *a*, and warms the air coming in as well as the room itself.

Wenham and Waters' hot-water system.

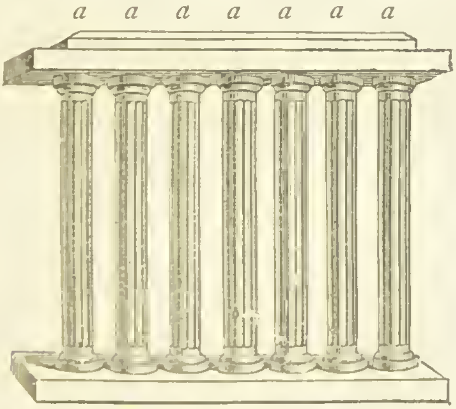


Fig. 16.—Wenham & Waters' Hot-water Coil.

available for the purpose as suggested, with gas jets and ventilators, then some form of closed stove on the slow combustion principle, and manufactured of fireclay, should be used.

Doulton's slow combustion stoves.

I can confidently refer to Mr. Doulton's slow combustion stoves as admirably fitted to economize fuel, to diffuse warmth, and save trouble as well as annual expense in housekeeping. They may be lighted over night in cold weather, and will keep the place warm for the following day, or, if lighted early in the morning in more moderate seasons, will warm the room most thoroughly in a few hours, but, being slow burners, they do not get up heat very rapidly, and it would not do to light them only just before the assembling of the school, at least in very cold weather. The quantity of fuel which they consume is, however, so small that it is advisable and not expensive to have them lighted over night in all severe seasons.

Schoolroom walls not to be allowed to get cold.

The temperature of a schoolhouse or classroom should not be allowed to fall below 45° at any time, night or day, whilst the school is in session. If the walls get quite cold, there is a difficulty in warming them again; whilst if the room is well ventilated immediately after the class has separated, and if cleaned up at once, as it ought to be, instead of being left until the morning, and if, in cold seasons, the stove is lighted and allowed to burn all night, the room will never get cold at all if Doulton's stoves are used, or two or three of the gas jets are kept alight. If Wenham and Waters' principle is adopted, the walls would not get cold at all. The stove which heats the water is a slow combustion stove, and when once lighted it should not again go out until the warming of the school is unnecessary. The expense of this is really small, as the stove only requires feeding twice, at the most, in the twenty-four hours. The walls of the room do not get cold, and the children are comfortable as soon as they enter the room on a cold winter morning, instead, as is too often now the case, shivering and quite unable to take in the teacher's meaning, until the warmth from their own bodies has warmed up the place. In the meantime, the radiation from the cold walls upon those children who sit near them may have inflicted very serious injury.

Exits for foul air must be larger than the entrances.

The exits for foul air should be larger than the entrances. The sashes of the windows may be so arranged as to allow a constant stream of air to pass out of the room. This is easily managed by having a plate of perforated zinc, or even canvas, stretched across the top of the sash frame. Canvas keeps out the dirt and blacks, whilst the minute openings prevent draughts, if perchance the passage of air should be in the reverse direction. I have sometimes arranged a Boyle's ventilator in the ceiling with gas jets at its base to compel up draught. The general difficulty is, that outlets of this kind are not large enough for the purpose. Watson's syphon system is a good one when skilfully applied, but it requires an intelligent appreciation of its qualities, and a determination not to allow its principle to be tampered with; otherwise it fails to effect its purpose. On the whole, I prefer Bunsen's burners for promoting the movement of fresh air, when the air outside is too cold for admission without warming, unless it is by means of hot-water pipes. The same channel promotes ventilation when the burners are not in use, and Boyle's ventilators in the roof are the best means of getting rid of bad air when open windows cannot be used. They should always be in addition to the windows, so that the latter may be closed when the outer air is below a temperature which is naturally bearable, say 45°. From what I have said, it is manifest that no schoolroom is furnished which has not at least two thermometers upon its walls, so placed as to indicate the mean temperature. There should also be within view of the teacher a thermometer outside one of the windows, which should be occasionally consulted, so that the temperature of the room may be properly regulated; and it should be a positive rule that at the end of every hour or hour and a half the school or classroom be emptied for ten minutes at least, and the **windows thrown wide open**, so that all foul air may be thoroughly removed at least once in the middle of the attendance.

Crowds raise temperature.

It will be seen from the foregoing that crowds are manufacturers of foul air, as well as of the draughts which nature sets up for its removal after its manufacture. Draughts will be best prevented by warming the air, which must and will get into the place that foul air has contaminated, when that contamination is accompanied by a rise of the temperature. One way to warm that air is by means of jets of gas so arranged as not themselves to be contaminators of the warmed air (fig. 12). There are many advantages in the use of gas. If judiciously adapted, it produces warmth at the same time that it removes the foul air manufactnred by the crowd. It obviates the mischief which arises from the concentration of heat in one place, such as is effected by open fireplaces. The greatest advantage attending its use is that it can be divided and placed in any room at any part at which heat is required. It obviates dirt and dust. coal bunks are not required, there are no smoky chimneys, and, as a consequence, when the use of gas becomes more general for heating, and especially for cooking purposes, there will be a considerable diminution of intensity in those dense fogs which now

Produce draught.

oppress large cities, especially London, and wherever coal is consumed in the wasteful way which is the custom at the present day. The use of gas for lighting purposes will gradually diminish, but its use for heating and ventilation is only commencing; a gas of lower illuminating, but greater heating, powers may be produced at a less cost than that of the gas which is now in use, and when it is available it will be found to be a cheap way of warming public buildings in places where gas is in general use. Even when 3s. per 1000 feet has to be paid for it, it is cheaper than coal, all things being taken into consideration; that is, if the arrangements are carried out in a proper manner. Fortunately the necessities of a period always bring forth the help which is wanted, and this is the case here, for the Gas Heating and Lighting Companies, and other private firms, provide every kind of help which is wanted in connection with warming and ventilation. There are very few places in which gas is not now available, and there ought to be no difficulty in its adaptation, except that which naturally belongs to a first expenditure of capital, but with that capital expenditure there will be a diminution of annual cost. No system of ventilation is satisfactory which allows the temperature of the room to rise above 60° in cold weather, or which does not allow the air to be renewed very many times over during the day. A school attendance without exposure to draughts of cold moist air must be a necessary part of the performance. I use the term 'cold moist air' because it is the presence of moisture which seriously adds to the evil of draught. Its opposite of dry hot air is similarly hurtful, and must be equally avoided. These conditions having been laid down, it is necessary that there should be

Coal gas as a warming, lighting, and ventilating power.

Objections to cold moist air.

Intelligent supervision required.

an intelligent supervision of the means in use, and that the laws which regulate these means should be understood by the attendant who is in charge of the school; otherwise, as the conditions outside are constantly altering, frequently in a direction antagonistic to those within, if the latter are not altered to correspond with those changes, there will be failure in the principle adopted, and a resulting evil, for there is no plan of ventilation which will be self-acting and equal to all changes. I have said that the method of ventilation is intimately associated with that of lighting. The part of my subject connected with light will be dealt with also in the section which will be devoted to eyesight, and I may refer you to that section for some further observations upon the point. The direction in which the light falls upon the student's desk or book is of great importance in connection with correct teaching. A combination of lights throws double shadows. The worst light is that which comes directly from the front of the scholar. It is not good for him to sit opposite to a window facing a bright light. The light should come to the scholar from a point on either side, or above the shoulder, or from behind him; that from the left side is best. It is not beneficial to have the light entering from both sides of the room unless it is a very large one. Those lights which are directly to the rear are bad, because they throw the shadow which is produced by the scholar upon his work. It is necessary, also, that the light should not be directly in front of the teacher. That position of it positively decreases his power of overlooking the pupils, and may at the same time be absolutely annoying to himself. It is necessary to arrange the work of the school upon the lines indicated by these suggestions. Abundant light is

Lights and shadows.

Position of windows.

absolutely required, and the more fully it can be arranged so as to strike the desk at a considerable angle, the better for the pupils. The higher the windows rise, therefore, in the wall of the room, and the nearer to the ceiling, the better also for lighting as well as for ventilating purposes. Windows that are too low down are not of so much use. The lower panes are of no service for lighting, though they are useful for ventilation when the windows are made to open both top and bottom. A school should have at least one-fifth of its wall space devoted to lighting by the sun's rays, and if it amounts to one-fourth so much the better for both health and education. A so-called dim religious light is opposed to health, and tends to develop the hysterical state so much admired and so much promoted by some schools of religious thought. It cannot assist to bring out a healthy mind, and, as a consequence, it must impede the healthy action of brain matter. Light goes with knowledge, and assists to develop mental power. A dim light probably impedes the formation of the habit of private judgment, and leads the person under its influence to lean upon somebody else: to follow the lead of the teacher more closely, in blind obedience to this *ipse dixit*; but it does not tend to health. That which does not produce a perfect state of bodily health, or impedes its growth, cannot be good for any body of people, and this applies to children much more than to adults. I object, therefore, upon points connected with Hygiene, to a so-called dim religious light. Light must be diffused as equally as possible all through the room: dark corners and dark ends should be got rid of by opening windows in the blank walls, or putting in skylights if the walls are not outside walls. The direct light from a skylight

Area of window space.

Oblique light.

is not so beneficial as an oblique light. Those schools which are to be used for drawing-classes will generally require that the light should come in from above as well as at the sides of the room. The more openings which can be made to communicate with the outer air, the better for ventilating as well as for lighting purposes. It will be found that a domed roof is better than a flat roof for both objects; and when skylights are obliged to be flat, they must be protected by proper blinds.

Domed roof best.

It will be right to give a few instructions upon the method of lighting by artificial means for those schoolrooms in which evening classes are held. The time for the use of the electric light in our schools has not quite arrived. The division of the electric light and accumulation of electric force at present is too expensive to allow of its introduction into the school and classroom; but the day is not far distant when the change will be made, to the infinite advantage of the general health of the people; some adaptation of Swan's Incandescent Light being the direction it will probably take. If gas is used for lighting purposes in the way that it is at present, it so completely deteriorates the air of the room as to quickly take out all the healthy vital properties which belong to it. Ozone is rapidly removed, and the oxidizing power of the air very much diminished thereby; that is, when gas is used with an ordinary burner. If it be enclosed in glass globes such as are made by Wenham, where the products of combustion are compelled to leave the room at once by a proper conduit (C, fig. 17), the evil is obviated. The conduit passes from the globe into one of the flues, or directly out of doors into the open air; whilst the gas itself is supplied with air by another tube,

Swan's electric light.

Wenham's gas-burner.

B, which draws its supply from some available source.

The evil of gas is also, to some extent, obviated by

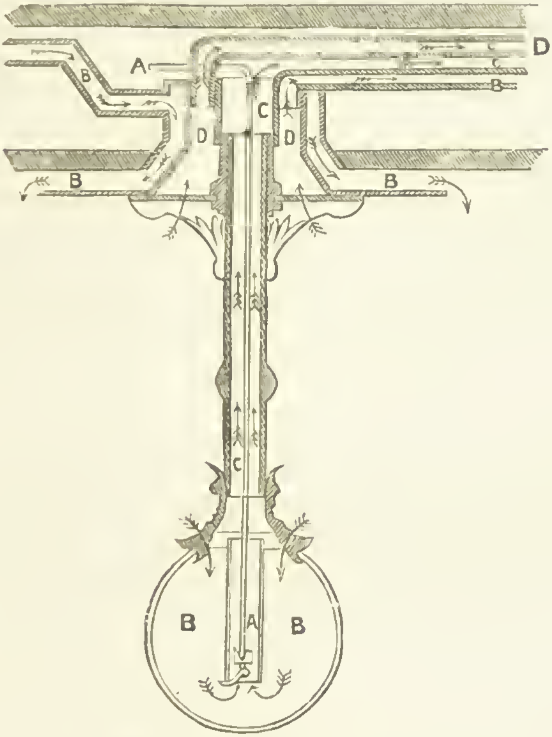


Fig. 17.—Wenham's Gas-Burner.

A, Burner and gas pipe.
B, Inlet into globe for fresh air, as shown by the arrows.
C, Outlet for products of combustion.
D, Outlet for foul air from room.

the ordinary sun-burner, which is fixed a short distance below the roof, with a chimney directly above it to carry off the foul air which results from the combustion of the gas; and with it also a portion of the heat is made to escape. The difficulty which belongs to the sun-burner, viz. its concentration, is overcome if gas is used with closed globes (fig. 17) in those parts of the room which the light from a sun-burner does not reach. Pendant stars, freely multiplied at a considerable height, are good means of lighting in lofty schoolrooms, provided ventilation be perfect in the roof, and floor space excessive; a very bright light may be obtained by using Wenham's burner, which consists of a platinum cone pierced with a number of minute openings for the gas, but the heat it produces is excessive. No method, however, except the electric light, is satisfactory, unless there is an increased power of ventilation, as regards the entrance of extra fresh air, whenever the gas is lighted. Rooms are generally provided with conditions of ventilation which may be satisfactory when the room is moderately filled in a bright, cool afternoon; but let it be filled full, and the gas lighted, when the lights are simply wall burners or standards, and then, in a very short time, the air of the room becomes absolutely pestiferous. It is probable that an immense injury is done to the public by the present method of lighting this class of room in the manner indicated; many churches and chapels are illuminated in this manner, much to the injury of the congregation; whilst in drawing-rooms and libraries there is much injury to the furniture and the books by the decomposition of the sulphide of carbon which is in the coal gas. To remove this great evil, all the products of gas combustion must be carried out of doors so quickly that there shall be no possibility of their being breathed by the children.

Wall burners and standards bad.

Cross lights to be avoided.

It is necessary for all the windows to be fitted with roller blinds, so that the light of the sun may be diminished when necessary, and the direct rays kept from interfering with each other, so as not to produce a cross light. When gas is used in a school during the teaching time, each lamp should be provided with a shade, by means of which the intensity of the light may be broken. The shade should not be so opaque as to cast a shadow upon the upper part of the room, but it should be just enough to allow the light to be looked at without inconvenience. Ground-glass shades are useful for this purpose. These are important points which will be referred to in another part of my subject, viz. eyesight. There is much difficulty from the ordinary sun-burner, so that it is all but inadmissible in common schools. If used at all, the bright light should be prevented from falling directly upon the desk of the pupil by properly managed reflectors.

Ventilate immediately the class is over.

I would urge managers of schools to ventilate the room well immediately after the class is concluded; get rid of all foul air before it has had time to be absorbed by the walls. The epithelial cells and other *débris* left in the place should be removed before they can be deposited in chinks and crevices, which are sure to be present. Have the floors swept as soon as the class is over, and then the place dusted. Then close up for the night, lighting the warming apparatus if the thermometer is likely to go down below 39·5; there will then be a healthy room for the children to assemble in in the morning, comfortable to their feelings, assisting them in their work, and making their control and management all the more easy to the teacher and his staff. The first half-hour is not then lost by the children in their efforts to get warm and to escape from the depressing effect of cold walls, which abstract warmth from the little scholars, and

The floors cleaned at the same time.

very often do them a serious injury. There is another part connected with lighting, but often neglected in all classes of schools. The windows are seldom cleaned. This is a duty which should be regularly performed. The deposit of filth from the breath is considerable upon a sheet of cold glass. If it be allowed to remain there and to dry up, it may be a source of mischief; it assists to depreciate the vital properties of the atmosphere, because it adds to the matter to be oxidized. It is not a large addition, but there is enough to propagate infectious disease, if germs of infectious matter should be deposited on the glass. A well-conducted school requires that the windows should be cleaned as regularly as the floors are scrubbed and the walls dusted down. To see that it is done is a duty that should be placed upon somebody, for it is attention to minor matters which certainly ensures that greater ones shall not be omitted.

Windows to be cleaned.

CHAPTER VII.

DORMITORIES.

It is now necessary to make a few suggestions upon the subject of dormitories. It is one which is closely related to that of warming and ventilation, and cannot be left out of our work without making a gap in it. Health at school is intimately associated with bedroom accommodation in those schools which lodge the pupils, and which are usually called boarding-schools. This chapter will, of course, be applicable only to this class, and scarcely form part of the instruction to elementary schools. To the former class, a consideration of the sleeping accommodation, which is or ought to be provided, is the most important part of school hygiene.

Study and dormitory not to be combinod.

There are different plans of arrangements in different classes of schools. In one kind the study and the dormitory are combined; this is a bad arrangement, and should not be tolerated. There is something more to be considered in this part of our work than pure air and simple sleeping accommodation. The morals of a school are closely connected with the character of the bedroom arrangements, and nothing tends so much to debase a bad boy's mind as the knowledge of the fact that he cannot be quietly supervised when at his work; that the master cannot see him without the boy himself knowing of the supervision. The knowledge is not injurious to the good boy, but the bad boy is sure to take advantage of it, and it will encourage the formation of habits which are never thrown off again if once indulged in. Study in the day-time should not be permitted in the bedroom. It has a tendency to make the air impure in spite of ventilation, and it allows of customs which will be indulged in, in the night as well as in the day-time. It leads the student to work at night, to keep awake when he ought to be asleep, and thus to alter the law of nature. The bedroom is for rest and sleeping, not for recreation or study. This is a rule which must not be departed from, for if children get into the habit of reading in bed, or when they ought to be in bed, it is certain to interfere with their proper rest, and deprive them of some of that repair which the nervous system requires, and which is best obtained when the sun is below the horizon.

Bedroom for sleeping in.

The next objectionable plan, at any rate for little children, is that in which the dormitory is divided into a number of compartments, which are sometimes called kennels, more usually cubicles. These have also the disadvantage of not being capable of easy supervision. It is the best kind of arrangement for young men or young women, if the partitions are simple, not complete, and if they are used for the purpose of privacy, but not sufficient to impede ventilation; but boys or girls under fourteen do not want privacy, and cubicles are not advisable until puberty is approaching. The partitions should only be about five feet high, or not more than half the entire height of the room, and should not touch the floor of the room except at points for support; there should be a few inches of space between the partitions and the floor. They

Entirely separate cubicles not necessary.

should be capable of removal for cleansing purposes, and in the holidays should be taken down and washed if they are wooden, whilst if they are canvas or linen, they should be properly disinfected by washing or heating and exposure to the open air for a few days before being put back again.

Partitions should be moveable.

The number of kennels in any given room should never exceed from ten to twenty,—twelve is a good number. They should occupy each side, with a passage between the two rows of beds, and if possible there should be a window between each two beds. Care should be specially observed that the windows should open top and bottom. There should be at least half as many windows as there are beds in the room, and the windows should each be within a few inches of the ceiling. There should never be more than two rows of beds in any one dormitory. These arrangements apply whether there are cubicles or not. Large dormitories are not satisfactory. I know of some containing forty beds. There are serious objections to large rooms. If a case of infectious disease shows itself, it is usually in the morning when it is discovered, and all the children who have slept in the same dormitory are, or ought to be, necessarily put into quarantine, and the larger the dormitory the more difficult this is to accomplish. I prefer at the most from twelve to twenty beds. From a sanitary point of view, the open dormitory is better than the cubicle; for young children it is also morally better, so that the teacher may be able to see the whole of the children at one glance; but as they grow up into young men and young women, they should be allowed privacy by means of cubicles. Evil habits are learned most certainly in very early life, and vicious practices will not be so likely to be indulged in after fourteen

Not more than twelve in one room.

Two rows only.

Open dormitories best for young children.

if they have not been learned before. No doubt the majority of children are opposed to vice, and it will not be openly indulged in in a dormitory. There ought to be a standing rule, also, which the tutor should take care to have completely observed, viz. that no boy or girl should be allowed to go into another's cubicle on any kind of pretence; vicious habits will then be reduced to a minimum, and be restricted to a very small class, even in the largest schools. These habits very often have their origin in nerve irritation, and are a consequence of disease in the first instance, and if a boy is not allowed to impart his tendencies to others who are not diseased, the mischief is stopped in the bud; whilst if it is not checked in this manner, much harm may result from its propagation, and the morals of a given school be utterly ruined by one or two vicious or irritable boys. This cannot arise in a well-ordered school in which the dormitories are properly supervised, and the children not allowed to visit each other whilst in bed, or to frequent each other's cubicles. I urge this as a most important part of school management. If fairly carried out it may be the means of saving many a child from becoming an inmate of a lunatic asylum later in life. Every child should have his own bed; the custom of allowing two children to one bed is a bad custom, and should be disallowed.

No child to go into the bed of another.

Separate bed for each child.

The largest part of the pupil's time is spent in the bedroom; it is very necessary that the air should be kept pure, and that the room should not be overcrowded. School bedrooms should be at least twelve feet in height, and twenty feet wide, and six feet should be allowed for each bed. This would give about 700 cubic feet for each occupant of the dormitory, and this is only sufficient if the ventilation

Cubic space required.

is good. The space allowed is often less than half this amount. In barracks the Government requires 600 cubic feet for each man. In lodging-houses it is sometimes fixed at 350 cubic feet; too little even if ventilation be satisfactory, but ridiculously small with the usual amount, which is often none at all. Children require nearly as much fresh air as grown-up people, but the character of ventilation provided is of more consequence than the cubical contents of the room. It is quite possible with good ventilation to do with 300 cubic feet per pupil for young children; without ventilation 700 feet will not be enough. If the height of a room is less than twelve feet, it is better to increase the distance between the beds on each side of the room rather than to make a wider room. It is to be borne in mind that a dormitory which is used as a sick ward, must not be occupied when so used by more than one-half the usual number of healthy occupants, and it may be taken as an established fact that, in sickness, twice as much air is required as when the occupants are healthy. Each boy should have a separate chamber utensil. It is not satisfactory for children to be encouraged to use such things in common, and it is a bad arrangement when there is but one utensil for several children and one common washing-place provided. Where possible, each should have a separate basin for washing purposes, and all the necessary appurtenances which belong to it in close proximity to it. It is not necessary for these to be by the side of the bed,—indeed, for certain reasons, it is better that they should not be so situated; but each child should have access to cold water, and there should always be a plentiful supply at hand, which should be obtained from a pure source without difficulty. The chest which

Separate washing-place, etc., for each.

contains the child's clothing should be placed beside the bed, and upon it should be placed some cold water. If the dormitory is wide enough, the wash-basins may occupy the centre of the room in a row, all being connected with one discharge pipe, which should lose its contents in an open receiver situated on the outside of the house, and from thence be conducted to the sewer. The receiver should have a proper trap, and the pipe connecting it with the sewer would be safer if it discharged on to a grating, and did not communicate directly with the sewer (see fig. 5); so that there should be a double impediment to the transit of sewer-air into the bedroom. The best kind of basins are those made of earthenware, which can be lifted up and empty themselves by swinging on an axis when they have been used, such as Doulton, Jennings, and other manufacturers make; they have introduced some excellent kind of basins, which are all managed on a good sanitary basis. The water supply for washing purposes should be plentiful and easy to be obtained. Each pupil should have his own basin, and be responsible for its being emptied and washed down after use. Care should be specially observed that the towels, sponges, combs, and brushes belonging to each child should be capable of easy identification, and should be kept for separate use. Each chamber should have a monitor, who should be in charge of the washing-places, and who should see to the proper arrangement and cleanliness of towels, brushes, and combs. There should be a place in each room, especially for girls, for the reception of hair which may have been combed out of the head. This should not be put into the washing-basin, and must be kept out of the drain pipes, as it is a frequent source of stoppage when it is sent into the sewer.

Wash-basins in centre of room.

Separate towels, brushes, combs.

Hair-oil prohibited.

The use of grease for the hair should be strictly prohibited. Hair-oil and pomades have certain uses among dirty people, but they are out of place for children who are clean in their persons. In olden times, no doubt, grease on the hair prevented the growth of certain fungi which produced disease in the hair follicles. These fungi cannot grow in greasy matter, but it is far better to trust to washing and brushing, than to grease, for this purpose. If, however, brushes are not kept in order, and are not restricted in their use to one person, it will be difficult to prevent infection when disease of hair does unfortunately find its way into a dormitory. Unkempt hair should be a breach of discipline, as much as a flaw in a given lesson. It is really important to observe these rules, for not only may ringworm and scald head be propagated by contact, but ophthalmia of an infectious character often invades schools, even among the higher classes, sometimes producing terrible mischief, when cleanliness is not insisted on in minute particulars. In all such cases there has been default on points of cleanliness. It is important, therefore, that towels, brushes, and combs should be kept clean, and be restricted to the use of one child only. Each child should have his own, and not be allowed to appropriate that of another boy. Immediately the children have left the bedroom the bedclothes should be thrown open, as well as the windows; and air freely admitted to the bed as well as to the bedroom. It is a serious mistake to have the beds made up as soon as the children have left the chamber. It is still more serious for the children to be required to make their beds before leaving the room. If they have to make their own beds, it should be done after morning study,

Cleanliness necessary.

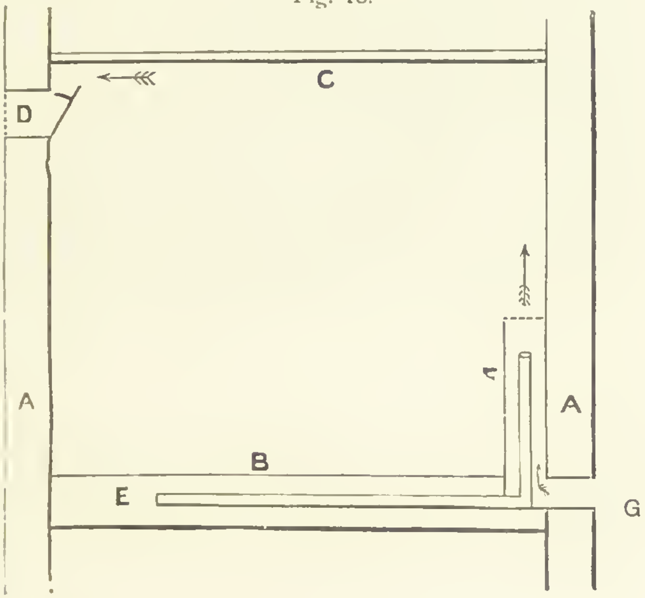
Beds to be ventilated.

and after the rooms and the bedding have been thoroughly ventilated, and no convenience of household arrangements of this character should be permitted even on the plea of tidiness: beds require to be ventilated as well as bedrooms. There should at all other times be a tidiness in the bedroom. The clothes which are taken off on going to bed should be placed in some kind of order, not thrown upon or under the bed, but folded up and placed ready for use in the morning. It is a mistake, however, to fold up the night-dress immediately it has been taken off, neither should children be accustomed to sleep in their flannel underclothing. Those garments require to be ventilated as well as the night-dress; it helps to deprive a child of the great benefit which arises from the use of flannel, if it is slept in at night; there ought to be sufficient clothes on the bed for a child not to require it as a covering.

Ventilation of bedroom.

It is very important that there should be a free admission of fresh air during the night, and a continual escape of some of the used-up air. Ventilation must be as efficient in the bed-chamber as in the classroom, and it may be provided in those places which have a gas supply in a manner similar to that recommended for warming and ventilating a schoolroom. However well ventilated a bedroom may be, it should not prevent the opening of the windows immediately the children have dressed themselves, whatever may be the character of the outside air. If there is no gas supply, ventilation is efficiently promoted by a large fireplace in which the chimney has been left open, with Louvre ventilators of large size above the door of the room. In summer-time the windows should be left open at night so as to admit fresh air from without. This requires an intelligent supervision, and must not be carried out by a hard and fast line. It is very unwise to allow children to sleep in air which is too cold; it is nearly as bad as allowing them to breathe the same air over and over again, or making them act as warming-pans for each other. In some large dormitories air-bricks are introduced in the walls below the level of the beds, near to the floor; they are made to open into a

Fig. 18.



A, Walls of room.
B, Floor of room.
C, Ceiling of room.
D, Sherringham's ventilator.
E, Hot-water pipe.
F, Coil in a Tobin tube.
G, Opening for admission of cold air from without.
The arrows show the direction that is taken by the fresh air, carrying away used up air at D.

kind of flue containing hot-water pipes. The principle is not a bad one if it be certain that warmed air comes into the ward. It sometimes acts in the opposite direction. The air must pass from the pipe upon which it impinges into the bedroom. Ventilators of various kinds are provided by different makers to allow of a continuous change of air.

Sherringham ventilator.

The *Sherringham ventilator* consists of an iron box inserted into the wall of the room near to the ceiling. It allows direct communication with the external air. The ventilator is covered outside by a perforated iron plate, whilst on the inner side there is a kind of hopper, which drops out of the box when the weight that is provided to keep it closed is taken off. The hopper opens inwards and from above, so that the air entering from without impinges upon the ceiling before it mingles with that in the lower parts of the room. The inside area is larger than the outside, and in consequence the velocity of the air is lessened immediately it enters the room, and draught is diminished: but it is cold air. A Sherringham ventilator may be used to draw off the hot air from a room, if a shaft is fixed on the ceiling above the opening for the ventilator, and passing into and above the roof (see D, fig. 18), or it may serve as an outlet if fresh warm air is obtained from some source similar to that provided by Wenham & Waters in their hot-water coils.

Watson's ventilator.

Watson's ventilator, referred to at p. 95, is a tube with a division down its centre, one tube being slightly higher than the other. The air enters on one side of the partition and escapes on the other. It requires that all other openings should be closed; and to be efficient must be very large. It is satisfactory for stables, but not for dormitories.

It is very important that the bedroom should be kept clean, that the floor under the beds should be dusted. A damp cloth should be used for the purpose, and if it be kept damp by water containing a small amount of carbolic acid, so much the better. The use of the carbolic water is not so much in destroying any possible infection, but in freshening up the air of the room and producing a rapid tendency to oxidation of any albumenoid matter which may happen to be present.

Incontinence of urine.

Besides the troubles caused to superintendents of large schools by the vicious habits to which allusion has been made, there are others arising from a class of children who are very often harshly treated both at home and at school,—I mean those children who are subject to a condition of things which leads them to wet their beds. This is a disease, and not a fault; no amount of punishment can possibly do more than make it worse. It arises from spinal irritation of a particular character, and must be met by special treatment under medical supervision.

In large schools it is best to have a dormitory for the special use of such boys, with bedding arranged for the purpose, properly protected, better warmed than an ordinary dormitory, and ventilated a great deal more than is usual in the ordinary sleeping-room. The children should be made to get up about an hour after retiring to rest, and to use the chamber utensil. If they have any difficulty on this point, it may be overcome by putting the hands into cold water. They should be made to lie on their sides and not on the back, and when found lying on their backs they should be turned over on to their side again. Then shortly before twelve o'clock, they should be roused, and the utensil again used. It will be found that the larger portion of the incontinence of urine (which is the name given to the complaint by medical men) takes place before twelve o'clock at night. It will also be found that they are heavy sleepers, and that there is great difficulty in rousing them, and that they are asleep again the moment they lie down in bed. Indeed, after a time they do not recollect that they have been roused at all. It is a cruel thing to punish a child for this misfortune. A room occupied by children so troubled requires to be visited frequently, and each sleeper examined. The disease may be cured by proper arrangements, and it will take its departure as puberty is approached, if not before.

Hours required for sleep.

I can scarcely leave the subject of sleeping accommodation without a word upon the requirements of nature for sleep, but it will be dealt with more in detail in connection with the medical aspect of the case. Young children from four to seven require to spend at least half their time in bed. A child of seven should have twelve hours' rest. The length of time to be spent in bed after that age may be gradually diminished, so that at fourteen nine hours is sufficient, at sixteen eight hours. It is important for health that this amount of sleep should be secured to children. The younger pupils should retire to rest first. It is a mistake to make children get up before daylight for the purposes of study. If the nervous system is properly refreshed, more work will be done in a given time than when the work is begun before daybreak, and by the aid of artificial light. The standard which is reached in schools where the children work by artificial light in the morning, will not be found so high as in those in which this kind of morning light is more seldom required. It is a custom in some schools to keep the gas alight all night for the purpose of supervision. It is a bad plan. Darkness promotes sleep; and a well-managed school, in which muscular exercise is properly regulated, should have no difficulty on the score of wakefulness among healthy children.

CHAPTER VIII.

PHYSICAL EXERCISE.

Functions and faculties require development equally.

THE narrow view of the function of the schoolmaster is well exemplified in some schools, by the entire banishment of physical exercise from the rota of school-work. We send our children to school for the purpose of training them for the battle of life, which they will have to encounter when they reach to man's estate. It is by the equal and continuous development of each and every part of the body that this battle will be fought with success, and if one part developes at the expense of another, or by its more rapid development puts a bar to the progress of the others, the subject of it is at disadvantage in his future struggles. Many a Cambridge wrangler and Oxford first-class man has found this out in after life. He is able to solve a problem in differential calculus, to make Latin verses, or to read a passage in any of the dead languages at sight, but he has not cultivated the talent of common-sense, or educated his muscles so that they can enable him to leap over some slight impediment in his path. He finds himself outstripped in the daily race by men whom he has been taught to despise, and who, in return, have a very small opinion of him and his mental power. The nerve force of thought in his brain has been developed at the expense of his motor power, and as the room for growth is limited, the latter is dwarfed and imperfect. Life is 'organization in action,' and the various functional activities of the body must be carried out with normal energy, and in a harmonious manner, if they are to be correct in their responses to any and every call that may be made upon them. Physical exercise is indispensable; and it is quite impossible for the functions of respiration and circulation to be carried on in a proper manner if the muscular system is not developed, and if the material which is necessary for the formation of the muscle is not used up in its proper order. If the muscles are not used equally with the brain tissue, some used-up matter is kept back, and will sooner or later act as an impediment to proper brain work, by getting in the way of the latter when it requires all the room which ought to be at its command. The assimilative and disarranging processes of the body are greatly influenced by the activity or inactivity of the muscular system. Hence it follows that no school is properly constituted which does not provide an exercise ground for its pupils, and make the cultivation of muscular force a part of its daily routine. This is not the place to deal with the general effects of exercise, but it will not be out of order to call to mind the fact that, the natural heat of the body being 98·4, it follows that something must be produced in the blood which is the *débris* of the continuous fire that is always burning, and by means of which the natural heat of the body is kept up to its proper standard. The principal product in this manufacture is carbonic acid (CO_2). There are other results, but their chemical nature is not certainly defined, and I need do no more than allude to them. The daily amount of CO_2

Muscle as well as brain must be used.

expired, as already shown, is very considerable; it is produced, in a great measure, *in situ*, and must be removed from the body. The larger the quantity continuing in the tissues of the body, the more impure is the blood; and the smaller the quantity remaining behind, the nearer the blood is kept to its normal standard. Now it has been proved that taking the quantity expired during rest in the recumbent position as 1, or unity, there has been expired, when a person is sitting, 1·18; standing, 1·33; walking one mile an hour, 1·9; walking two miles per hour, 2·76; walking three miles an hour, 3·2; riding on horseback, 4, walking at four miles per hour, 4, running at six miles per hour, 7. Thus it is seen that the quantity excreted is increased seven times whilst running quickly, as compared with rest in the recumbent position. In connection with this elimination of CO_2, there must be a corresponding removal of other excreta, with marked increase in the absorption of oxygen, and greater ability to maintain the animal heat at its normal standard, without requiring a warmer atmospheric air to live in. It will be easily understood by this one illustration how it is that exercise in the coldest air is accompanied by increased warmth, and that the colder the weather is, the more need there is for a greater amount of exercise. The union of the oxygen with the carbon, which is set free by the process of assimilation constantly going on in the body, which union takes place in the muscular system more actively than in any other part of the body, produces a warmth of a most decided character, and the production does not cease with the cessation of the exercise. The manufacture of warmth in this manner is very advantageous to children, and any complaining of cold should be

Exercise promotes warmth.

Expels CO_2.

persuaded to warm themselves by the combustion of carbon in their own frames, rather than be encouraged to obtain it by warm rooms and hot bottles to the feet, blazing fires, or any other means than by producing warmth within themselves.

Muscular tissue wastes if not used.

There is also another aspect of the case: muscular tissue wastes during long-continued rest. Any person may find this out for himself if he notes his muscular power before and after a few days of enforced confinement in bed; and there is no doubt also of the growth and increased strength of muscle by exercise. If any man changes his occupation, say from a clerk to a blacksmith, the comparison of power in the muscles of his arm at the end of a year will be found to efficiently prove this statement; but if the blacksmith gives up his anvil and takes to the pen, within a year the powerful deltoid muscles which he formerly possessed will be dwarfed and comparatively impotent. Let a man or a boy have sufficient intervals of rest between his times of labour, and whether that labour is brain work or muscle work it will tend to increase the power of the organ exercised, and the action of the one will by its own work clear the blood from the *débris* which has been produced by the work of the other. The more powerful minds will therefore be found among those men who do not neglect their muscular development; whilst the total neglect of mental work, which bodily labour sometimes compels the sons of toil to submit to, keeps them at a lower level in the scale of humanity than will be the case when both systems are allowed a chance by being worked alternately, as they ought to be in every well-ordered school. We must bear in mind that by exercise the individual fibres of a muscle increase in size, new molecules are developed from what are

Use increases power.

called the connective tissue corpuscles. These are exceedingly minute objects lying in the interstices between the fibres of the muscle. The contraction of the muscle is one of the means by which an ample supply of blood is brought for the nourishment of the new tissue. If exercise is not forthcoming, the tissue dwindles and becomes fatty in its character, loses its proper elasticity, and does not leave room for new cells to take its place, for it is not removed in the way that a regularly-exercised muscle is. If in addition to neglect of exercise there is the consumption of abundance of food, the victim grows fat, and laziness increases in a corresponding ratio, until some disease developes in consequence. The elaboration of new muscle is the immediate effect of the activity of the old, and if the old is not used, it fails when a sudden call is made upon it.

Idleness promotes fat formation.

It is, however, possible to carry on exercise to too great an extent, and whilst some schools ignore the necessity, others go on the wrong principle, and carry it on to excess. So long as muscle conforms to what is called the principle of rhythmic nutrition, its bulk and effective power increases, but long-continued over-exertion tends to induce a condition of chronic exhaustion, ending in wasting and decay. There must be time between the movements for the removal of *débris*, and for the recharging of the battery of nerve power which directs the movements, otherwise the symptoms which indicate muscular exhaustion come on. These are sometimes very marked when exertion is confined to a very small class of muscles. It is sometimes so marked as to constitute a distinct disease, and is called by various names, as scrivener's palsy, type-setter's, violinist's, tailor's, or milker's cramp. Various trades in which the exercise of only one set of

Excessive exercise injurious.

muscles is used, and used continuously for many hours together, are subject to these conditions. The causes which produce such states give us an insight into the conditions which are to be avoided in the playground. 'Professional muscular atrophy' is the result of a condition which is the opposite to nonuse.

Professional muscular atrophy.

Besides the muscles which may suffer from over-exertion, the blood-vessels are liable to injury. Foundations are laid for mischiefs later on in life, and dilatation of the cavities of the heart, or of the large blood-vessels, allow of aneurism being set up, or the smaller arteries and veins give rise to a state corresponding to varicose veins in the leg, which are the result of too long-continued muscular exertion. Athletic exercises, therefore, may be in themselves sources of danger; and violent and long-continued work, either at cricket, or boating, or at football, or in the racket-court, must not be allowed at all to those who are not trained to it, and who have not gradually brought their powers into accord with the work they are called upon to perform.

There is an outcry at times against the continuance of violent athletic sports. It seems to me highly undesirable that they should be abolished; they ought, however, to be carried on under regulations which the monitors and masters in the school should enforce. These pastimes, when carried on in large assemblages of young men, should be under regulations supervised by a responsible officer; and racing crews, football teams, and cricket elevens, intending to enter into contest with other similar parties, should be picked out from men who have been gradually inured to the work, and who have not been absent from proper drill for any length of time together. A boy has, perhaps, been away from school on account of illness

Long-continued exertion to be avoided by those out of training.

or for some temporary cause; and after an absence of two or three months, on his return takes his place at the head of his team, he enters at once into some contest in which there is a call for sudden and long-continued exertion; the result is the foundation for a disease of the heart, or dilatation of some artery, which produces aneurism at some later stage of his life, or some other strain arises, the effects of which are permanent. Extreme exertion embarrasses the heart; the flow of blood is impeded from the right side of it, for the increased pressure upon the inner surface of the air-cells impedes the flow of blood through the lungs. These air-cells are sometimes ruptured, and that happens in the boy which is recognised in the horse when a state of things arises which leads to the condition called 'roaring.' If there has been a proper training, this does not arise. The individual is said to have gained his 'second wind;' he breathes regularly, and, under heavy and long-continued exertion, goes on properly, and he is enabled to continue up to the limits of muscular exhaustion, unless stopped by a stitch in his side. This stitch arises from the liver becoming engorged with blood, and it is unable to transmit the quantity through it which rapid exertion has brought into the venous system of the lower extremities and the bowels, and is nature's way of stopping mischief.

'Roaring,' and 'second wind'.

The skin flushes during active exercise, there is congestion of the cutaneous vessels, and perspiration results. This action keeps the temperature of the body at its normal standard. If the skin acts imperfectly, the accumulated heat excites languor, and indisposes to further exertion, just as in the case of the lungs. If a boy is in good training the circulation goes on properly. There is not profuse perspiration,

If very hot from exertion, be careful not to be chilled.

but only sufficient to carry off excess of heat. It is important, however, for boys to beware of the dangers which may result from the custom of trying to cool themselves when too hot, by allowing evaporation to be as rapid as possible. A large loss of heat takes place in this way. The pores of the skin are suddenly closed by the cold, and the discharge of *débris*, which was taking place in the sensible perspiration, is stopped; the excretion is thrown back into the circulation in a state which does not belong to it, and, as a consequence, a condition arises which is called 'taking cold.' It really is a state of self-poisoning by returning into the circulation some morbid matter which ought not to be there at all, and which the skin was naturally excreting. When a boy is very hot, it is better not to allow this gradual chilling to take place upon any account whatever. If he has been running just before he goes into his bath, let him strip and plunge in as quickly as possible, and come out again in a very short time. The bath will refresh him, and the reaction will bring back to the skin that which was being excreted; but if the vessels are allowed to be cooled too much, they will not again relax, and there is no power to continue the process of excretion in a proper manner; the boy remains languid and tired, and it may be that a serious illness is set up. It is unwise to go into the water when in a great heat at all, unless a sudden plunge in and out is alone indulged in, in which case there is a refreshing action; but boys, as a rule, should not take violent exercise just before bathing.

Violent exercise must not be taken before bathing.

Just as particular muscles may suffer from professional atrophy, so certain parts of the brain may suffer in a similar way. If a boy is kept at one form of work too long—say if he is not allowed to do anything else than try to solve some of Euclid's problems, or if he sets himself to do some such task—it is possible that there may be over-strain of that particular part of the brain upon which mathematical power may depend, and such an one will never become a reasoning genius.

Brain work requires rest as well as muscle.

Brain work must have its rhythmical movement and time for rest as well as muscle. There must be time for the removal of used-up brain matter, time for the renewal of new tissue, and for the recharging of the nerve battery, which has been used up in the work which has been done. Teachers are great sinners in this respect. They neglect physical exercise themselves, and, as a consequence, get a low standard of health, suffering as much as most men from these conditions which are styled bilious, and which they connect with indigestion, but which really arises from the retention within their circulation of the *débris* of nerve tissue and the remains of used-up nerve force.

Space will not allow me to go into all the different forms of exercise, or to analyse the muscular movements which are brought into play in each kind in minute detail. The cultivation of muscle is being recognised as a part of school work, and each in its turn becomes a useful part of muscular training.

Training.

'Training,' says an eminent writer, 'is to put the body, with extreme and exceptional care, under the influence of all the agents which promote its health and strength, in order to meet extreme and exceptional demands upon its energies;' but I have met with instances in which so-called 'training' has done everything but this. It has not promoted health and strength, but has exhausted the bodily power, and done more mischief than good. The course of training which is recommended by the fast men of University life, or by the pugilists of fifty years ago, is not the training which boys and girls ought to submit to, except so far that the habitual use of intoxicating liquors is rightfully and reasonably prohibited, and stimulants are in no case required to produce a development of either mind or body. The old trainers had found out this fact. The requirements of a growing body are not the same as those which belong to the adult. In the one case, muscular exercise is used for the purpose of development; in the other, it is used to remove the *débris* which arises from the act of living, and in order to preserve the constitution from the dangerous result of the oxidation of this *débris* in the wrong place and at the wrong time. If one set of muscles develop in the child, and not the other, there is distortion of frame and a want of grace and of elegance in movements. The chest may be contracted, and the lungs deprived of the room which they ought to have for the necessary purification of the blood. Gymnastic and calisthenic exercises tend to produce a straight back and an upright figure, provided all the muscles are exercised in their turn; the avoidance of them may lead to round shoulders, twisted spine, stooping and shuffling gait, and shortness and imperfection of vision. The curvations of spine which are common to young girls in consequence of the want of exercise, lays the foundation of much of the mortality, or, at the least, of the acute suffering which follows upon child-bearing later on in life. Spinal curvatures are more common amongst girls than boys, because the latter do get more natural exercise than the former.

Exercise has two objects. A cleansing process and a development.

THE VARIETIES OF EXERCISE.

Walking, leaping, running, rowing, swimming. The muscles which are developed in each kind of exercise might be considered in this part of my subject, but the space at my command is insufficient for the purpose. I might also consider the natural varieties of exercise as brought out in cricket, fencing, football, rounders, rackets, tennis, fives, and even the more plebeian games of leap-frog, hop-scotch, blindman's buff, and the use of the skipping-rope. Each and all are useful in their ways, and should be encouraged in their season. Systematic physical education, by means of gymnastic exercises in which muscles are brought into use in rotation and according to scheme, is undoubtedly beneficial under certain circumstances and in crowded localities where it is impossible to have the use of a proper playground; but a school is not properly constituted which has not the use of an exercise ground in correspondence with the number of the pupils, and every hundred boys ought not to have less than an acre of playground, though I am quite aware that this is all but an impossibility in London and our largest cities. Still it would be much better for the nation if schools could have as much. The national games I have mentioned are far superior to any artificial system which has ever been laid down by authority. All that is required is, that exercise shall be brisk, and the respiratory muscles brought fully into action. Appetite is increased by it; more food is assimilated in a healthy fashion than can possibly be the case when no regular exercise is taken; the system becomes properly tired out, and at the end of the day 'nature's sweet restorer, balmy sleep,' gives that rest to the weary which 'nature's soft nurse' is ever ready to afford to those who follow her dictates and obey her behests. I may illustrate the value of systematic exercise by a circumstance which occurred at the Anerley School a few years ago. The school authorities had engaged a drill-master to drill the

Kinds of exercise.

Produces sleep.

Exercise at Anerley School.

young urchins who are taken care of in that great establishment. The expenses of the school are paid for by the Boards of Guardians out of the poor-rates of three or four combinations of parochial authorities of some of the parishes on the south of the Thames. The fact of a drill-master being engaged to drill a set of pauper boys was too much for the rate-saving portion of some of the Guardians, and strong representations were made to the Board of Management against this apparently useless luxury, and as a consequence of the opposition of the paymasters, the drill-sergeant was superseded. Previous to his first engagement there had been great difficulty in the boys' dormitories. Mischief was constantly perpetrated in the night, bolstering and other amusements in the still hours were not uncommon, to the serious damage of the bed linen, night-dresses, and other articles in the dormitory. Coincidently with the introduction of the drill-master, this source of damage seemed to disappear. It revived soon after the dismissal of the drill-master, and then it struck the Chairman of the Board of Management that there was something more than a coincidence in this, that the two results had an alliance as cause and effect. The expense of repairs to bed furniture and night clothes was very much larger than the salary paid to the drill-sergeant. The cost of the one, upon close inquiry, was found to be more than three times the cost of the other. The Board determined to restore the drill-master as an experiment. By his return, quiet was obtained in the night to the occupants of the dormitories, and a serious loss to the managers prevented. The boys were properly tired out; even nightmare was comparatively uncommon under the new *régime*, sleep was sweet, and the boys no longer disturbed each other by horse-play at the wrong time. It is impossible to have a more striking instance than this of the beneficial influence of tiring exercise. I meet with the ill effects which are caused by its absence, especially among clergymen, who, before becoming vicars of a parish, were accustomed to strong exercise and even horse-play, but becoming vicars, they dare not descend to the playground, and as a consequence their health suffers most seriously. I am accustomed to recommend muscular Christianity in the cricket-field.

Muscular activity necessary for girls.

The neglect of exercise is more marked in girls' schools than in those which are provided for boys, whilst females suffer in adult life even more than men from a neglect of its requirements. The restraint upon their freedom of motion, both by custom and the improper character of their dress, tends to increase the mischief. Girls should exercise themselves quite as much as boys until they reach the age of twelve or thirteen, and there is no reason whatever why they should not be as active in their movements, and as energetic in their play, as boys are. Cricket, fives, rounders, and even leaping and swimming, should be encouraged. Their dress should allow of this freedom of action, and prudish notions of such conduct being unfeminine should be put aside as contrary to health. When girls become young women, and natural changes are taking place in their constitution, it may be time to change the form of exercise to something a little less boisterous; but rapidity of muscular movement, which rapidity should at times apply to all the muscles of the body, should be encouraged in girls at all ages. The use of the skipping-rope for boys, as well as girls, is to be encouraged, because it exercises all muscles equally, and does away with the tendency which is always present to take to one set of muscles more than another, and to throw the machine out of balance by developing the right side more than the left, or *vice versa*. I am in the habit of recommending parents when they find certain kinds of deformities to be threatening, to encourage their children to trundle a hoop with the left hand, the right being tied behind the patient; or to play at shuttlecock and battledore with the left hand, the right being similarly treated. This would be a very good kind of exercise to encourage in all schools, so that each set of muscles may be equally developed, and young children taught to use the left hand as much as the right. There is much yet to be learnt as to the nature of exercise; the ordinary drill-master is not *au fait* to his work if he only brings out the powers of a few sets of muscles. A number of children are set to perform the same work without reference to their mutual fitness to act together. Tall and short, thin and stout, all are called upon to do the same thing in the same manner. It is always necessary to classify when teaching in muscular as well as in brain work. Indeed, until children have had a good general muscular drilling they ought not to be allowed to enter for competitive trials in athletic sports.

Avoid the use of one set of muscles only.

There are various systems of physical education, such as the Swedish system, in which free exercise of muscle is carried out without gymnastic apparatus. The child is taught to assume certain positions and perform certain movements, which tend to bring out the expressions which make men actors, orators, or sculptors. This is styled the æsthetical part. The military part is connected with sword, foil, and bayonet exercise. There is another form called the movement cure, which embraces special exercises for the removal of deformities, such as spinal curvature, by manipulation.

The Swedish system.

In the case of *free exercise* the muscles are brought into play in sets from head to foot: a regular rhythm is encouraged by music. It includes the physical culture of the senses as well as of the muscles. Singing is a part of the plan. Vision is educated for the purpose of distinguishing colours and shades of colours. The sense of touch is educated with the sense of smell, taste, and hearing. There may be difficulties in the way of some of these, but the development of muscle by the aid of singing should be compulsory in all schools; greater attention to this so-called Ling's system would be an advantage in our elementary schools. It should be commenced in the infant classes as physical exercise, passing on to the æsthetic among the older children, and ending with the military after the age of thirteen.

CHAPTER IX.

TIME ALLOTTED TO STUDY.

Mental application must not be too prolonged.

THE teacher should always bear in mind that long-continued occupation in any one direction is not good education, that excess of mental application is injurious to bodily strength, and that intemperance may refer to mental work, to bodily exercise, and the digestive functions, as well as to excess of liquor. The listless and reluctant attention which is met with in some schools is the opposite to that which holds good in those which are properly managed. Instruction must be adapted to the child's power; the talk must be made pleasant to the pupil if it is to be rapidly understood. It is a great mistake to suppose that many hours per day must be devoted to study. Little children may be taught by playing with them and by instructing them in their play and by their play much more efficiently than by compelling their attention in the solemn way which is followed in some dame schools, and even in schools for older children. To sit on a form and be quiet is necessary sometimes to enable the teacher to bring his class into proper subjection, but to make it the custom of the school is wrong. Sedentary occupation is altogether out of the question for little children; half an hour at one time is ample for them to be compelled to devote their attention to any one subject. There should be a relaxation for a short time every now and then for absolute play; a time for the muscles to follow their natural tendencies. For very young children even fifteen minutes is a sufficient length of time for close attention to one subject. Two or three hours a day at irregular intervals of corresponding length is ample time for mental work for children under eight years of age. It is right, no doubt, to cultivate the memory and to encourage it to become a storehouse of fact, but the parrot-like teaching which is thought to be the right kind of work in many schools is a wrong principle. Memory without any appreciation of the values attached to words is useless for the purposes of education. It is probable that fully developed brains cannot stand more than nine hours' continuous mental labour for any length of time, without paying for it sooner or later. The gradations from three hours to nine may be gradually brought about by an increase of about a third of an hour a day for each year. Let any one calculate the amount of attention which can be given to a sermon or lecture, without the supervention of *ennui*, which marks the weariness of the listener, and if the subject is not very interesting he will be able to calculate the damage which school life does to brain development when irksome work is made more irksome by being too long continued. The Kindergarten system is an admirable one for young children, provided it is not kept up by excitement. I fear that sometimes the teacher errs on this side, and by trying to excite the attention of the little child, he, or rather she, overestimates the power of the little brain by introducing exciting topics and figures in a way which provokes attention; this kind of teaching is wrong. Ingenuity and vivacity on the teacher's part are

Nine hours per day the outside time allowed for brain work.

necessary, but excitement is to be deprecated. For children over four years of age, and under seven, an hour or two in a Kindergarten school, with frequent and short intervals during which the will of the child should be master, will be the best discipline. No set lessons should be permitted until the age of seven or eight years. I am of opinion that the teaching of our veteran hygienist, Edwin Chadwick, is right teaching, and that the so-called half-time system among older children will bring about a healthier and better developed population, than that kind of education in which the whole time is given to study. It is found by experience that children who attend school only three hours a day frequently make as good progress as those who are in the schoolhouse for six hours; the mental work, if continuous, is as much as is good for the child, whilst it gives evidence of real progress. I like the plan of emptying a schoolroom every half-hour, and allowing ten minutes for healthy exercise out-of-doors, which should take the form of leaping, running, or some other active movement of a vigorous and spontaneous character; if this is not possible by reason of the state of the weather, then a kind of drill should be practised, either in the schoolroom, or, better still, in some covered way, or in some other room, so that opportunity may be given for a purification of the vacated room by an extra ventilation. I like the plan also which is adopted in some schools, of regular drill at irregular intervals whilst at work at the desk. On a given signal from the teacher, say a particular kind of bell sounding, all the boys start to their feet at 'attention,' and perform a few muscular movements in rapid and regular succession. This introduction of the Ling or Swedish system should be encouraged in all elementary schools. The change

Half-time system more satisfactory than all the day work.

The temporary use of Ling system beneficial.

promotes a perfect circulation in the blood; it takes away from the muscular system a tendency to improper contraction, that which gives rise to annoying habits many people get of beating time in a way which is sometimes called 'the devil's tattoo,' or having other 'peculiarities,' indicating a deformity of nerve force. The drill is also advantageous as teaching children to be in subjection in a proper manner, and without injury to any part of the system. It also prevents them from becoming so absorbed in their work that they forget other duties altogether, and become what is called absent-minded, to their serious detriment in after life.

OVERPRESSURE IN ELEMENTARY SCHOOLS.

The passage of the Education Act of 1872 marked an era in the progress of elementary education which is likely to have immense influence upon the physical development of the nation. Our duty is to do as much good and as little evil as is consistent with progress in the right direction. Whilst the director is human, and the directed human also, there will always be some evil in every good work, and the early education of the young child be occasionally erroneous. The popular outcry of the last few years has not been without its use, and the statistics show a lower death-rate among children under thirteen years of age than before the Education Act was passed: proving that the conditions under which children live are safer now than they were before that Act became law. Yet in the face of the increase of population in towns, and its diminution in rural districts, teachers must be careful to see that physical exercise and education in muscular development goes on equally with the growth of brain power, unless we are prepared to produce a race

Death-rate reduced by school-life.

of idiots instead of giants. It will be found in practice that no child can beneficially attend consecutively to a single lesson for more than a quarter of an hour when less than seven years of age. The lesson may be twenty minutes from seven to ten, gradually lengthening as the child grows older. I know some schools in which the lesson is given out by the teacher some time in the afternoon, before the school is dismissed, and the scholar is expected to learn it at home. The preparation is a work of entire indifference to the master, provided it is learned when the scholar comes up for examination the next day. This plan of providing home work for young children in elementary schools is to be deprecated. The work should be done in the schoolhouse in short demonstrations upon it, so as to inculcate the facts which are embodied in the work itself, and by that means its importance is impressed upon the mind of the scholar. Sight, hearing, and thought should be exercised as well as memory This latter is, under ordinary circumstances, the only faculty brought out by home lessons, and it is a very treacherous platform to rest upon, unless the faculties of application are also utilized. Change of thought is also necessary for healthy development of brain power. The regular use of alteratives, or antagonistic work, should be encouraged: a change of subjects, which should be as diverse as possible, and strongly contrast with that which was promoted half-an hour before. So physical exercise comes in between strong mental action. 'Mental gymnastics' may be much admired, but an equal all-round man is of more value to the nation than the man who can repeat Homer or Virgil from the first to the last line without a mistake. Renew interest in the new work, exercise the intelligence of the child upon the matter before it, keep

Home lessons to be deprecated.

Good-humour necessary in teaching.

him in a pleasant frame of mind; for children, like plants, revel and delight in sunshine, which may be translated as cheerfulness and good-humour. Laughter and merriment are not out of place in the schoolhouse between the lessons, which should never exceed, on the aggregate, four hours a day for a child of eight years, five hours for eleven years, six for thirteen, and so on, in proportion, up to nine hours for young men and women. The time of year is to be also taken into account; lessons must not be pressed during the hours of darkness, and so much is not to be expected from children in the winter as in the summer months. More bodily exercise is required to keep up temperature, and there must therefore be less time for mental work. In elementary schools the children should be dismissed as soon as the sun has set, or it is too dark to see the work without artificial light.

All-round education in early life.

To avoid overpressure there must be good classification, short lessons, frequent intermissions for physical exercise, a good hygienic condition of the schoolhouse, warmth without heat, an absence of fear, and a healthy emulation as to the position of the scholar in his class. This will be best brought out by change of subject, and an all-round foundation for learning, rather than unequal development in brain tissue. The time for the increase of special faculties comes when the good all-round foundation has been laid, and, by that means, genius and good common-sense go together, instead of high ability in one direction, and foolishness in the common things of life, such as is too often exhibited by those who have had one talent developed to the exclusion of the rest.

EXAMINATIONS—REWARDS.

In some schools the greatest energies of the teacher are directed so as to bring out the latent talent of his scholars at examination time ; and everything is made to give way to this, his fixed idea. Some masters neglect the rank and file of their school, and pay most attention to those scholars who appear to have genius for particular work. The great success of a few, with a very moderate average, indicates defective tuition. It is true that uniformity cannot be looked for, but the general run of scholars will come up to a good general average if they are all equally taught. The slow ones in the school, and those who are frequently absent in consequence of indisposition, are generally neglected as not likely to reach the required standard at examination. It is better that examinations of the class should be held by the teacher at frequent intervals, and that the position in the class should depend upon these rather than upon the accidental ability of a scholar to answer a question suddenly put, by which a boy is sometimes sent from the bottom to the top of his class. Advancement should never be due to such accidents, but should be based upon a total of successful answers at the end of a given time: as a scholar gets older, and written papers are set, the difficulty is lessened upon this head. It is right to have this kind of examination frequently in the term, so that the child may be prepared for the final issue at the end of it. The examination should not last too long, and there should not be in it anything to discourage or depress an ordinary scholar. Promotions in place, decorations of a simple character as indicating that place, privileges as to seats in the school, and the right to wear a certain form of cap,

Frequent examinations.

are the best kinds of reward for school work. At the same time priggishness and bumptiousness is not to be encouraged: when a scholar shows a tendency in either direction, it is the duty of the teacher to discount his work, and check the fault. Scholarships, prizes of books, and certificates are of real service in every school; for the emulation which leads a boy to desire to win a prize, very often arises from love towards parents, and a desire to give them pleasure, as well as from the less praiseworthy motive of triumphing over a fellow-scholar. The moral conduct of the scholars should always be supervised. The best police in the world are those who belong to the people for whom they are acting, whose sympathies are with the people, but who desire to do their duty in their official work. The best police in a school will be the mass of scholars themselves, not for the exposure of vice, but for the reward of virtue. Every school should have a prize which should be awarded by the children themselves, to the first, second, and third child in the school who obtains the suffrages of his or her fellows by actual vote. Three names being written by each upon a piece of paper, and the three who obtain the highest numbers should have the prizes; those who have already held the prize being handicapped, or ineligible for it at the next competition, having a good conduct badge in its place, provided the name is returned with a majority of approvals. This good conduct badge would become a desirable distinction, and might be made the means by which the moral standard of the school would be continually raised. Scholarships and prizes should be given by the managers for general excellence to the younger children. No prize for a particular subject should be awarded until the age of fifteen has been reached; after that time, if a boy or

Scholarships, prizes, certificates.

Prize to be bestowed by scholars.

girl has passed a standard to be agreed upon, it will be time for him to take up the study of one or two subjects only, and to make himself fully proficient in those. The enormous mass of work which belongs to every branch of art, science, and literature, renders it quite impossible for a boy to distinguish himself in many different studies. Having gained a good general knowledge, he should take up one or two only, and devote himself to those according as he may propose to employ himself in his adult stage of existence; but every man should, besides his business, have a hobby which should not involve responsibility. I am in the habit of advising the professional man, the merchant, or the tradesman to engage in some study which is outside his office, counting house, or shop, and to which he may turn when away from business, with the certainty that by so doing he will get even more rest than by doing absolutely nothing. The rewards of society will be bestowed on such a student to the latest stages of existence. He will also avoid that contingency which so often happens to men who are obliged to retire from business from unforeseen causes: they soon break down and disappear from the platform of life, simply from rusting out. I have often said it is much better to wear out than to rust out, besides being a much less likely thing to happen.

General knowledge.

Special subjects.

PUNISHMENTS.

These are difficulties in all schools. It is important that when inflicted they should not lower the dignity of the child too much. There are two kinds: the corporal, and the moral. There is an idea in the minds of many educationists that corporal punishment should never be allowed to be inflicted in any

Corporal and moral punishments.

school, and personal chastisement is prohibited in most nations on the Continent. I think this is a great mistake both physiologically and practically, at least as regards very young children. Those who understand the effect of what is called counter-irritation in disease, will see how evil passions may be influenced by the counter-irritation of the birch rod upon that which is said to be the least sun-burnt and yet most fleshy part of the body. There are certain moral delinquencies which cannot be overlooked by the managers; and if the boy or girl is to be continued in the school, the evil can only be met by the infliction of corporal punishment. The managers should see that it is only inflicted by the head-master after a judicial inquiry, and never on the spur of the moment. Anything like a box on the ear, a blow of any kind on the head or face or front of the body, should be strictly prohibited. The penance of standing on one leg, or any other similar penance, is absolutely barbarous; and blows upon the palm of the hand are possible sources of danger to a delicate organization, and should not be allowed. There is no danger in stripes with a cane upon the lower part of the back, which may be administered in the presence of a chosen few, and should not be inflicted before the whole school, though every such punishment should be published. To pull the hair, to pinch the ears, to rap the knuckles, are all equally wrong. When I was a visitor at one of Her Majesty's jails, whilst they were under the management of the county authority, we were accustomed to award a punishment to a refractory prisoner, and allow the governor to hold it over during good conduct, with the most beneficial results. Three stripes to be administered next time the boy offends would often prevent the infliction of such punishment

Corporal punishments.

Deferred punishments.

altogether. This should be arranged that the award should, if not inflicted within a certain time, as a month, then lapse altogether. Some years ago a great outcry was raised in the daily journals, because a prefect in one of our great schools had administered corporal punishment to another boy without the knowledge of the master. I made many inquiries at the time of boys in public schools. I found that a large part of them were in favour of the system, and in the school in question I know that the boys always looked at their masters as their especial friends. The prefects, or head boys, were the supervisors of morals, and inflicted the corporal punishments, and appeals to the higher authorities seldom arose. But the principle was radically bad, and had to be altered, so that the head-master alone is now allowed to award corporal punishments in that school.

Moral punishments.

The plan adopted in some schools of writing out so many lines, is a barbarous and useless kind of infliction. The stoppage of leave out is better. There are various ways for producing a moral effect, which a judicious master will arrange, and which must depend very much upon the nature of the school and the occupations of the parents of the scholars. It is important that the punishment should never be inflicted for failure to learn a given task. A score of circumstances may have prevented the performance of the act of memory, and punishment is much more likely to be unjust than just, and no master who is equal to his work will be in any difficulty in finding a substitute. But dark rooms, or to exhibit the scholar with a fool's cap, and so make him an object of derision to his fellows, are not right ways to set to work. To keep them in after school hours, and depriving them of their regular meals, are bad plans. There should be a moral influence, such as the deprivation of some object of pleasure, as prohibition of taking part in a cricket match or football contest, for older boys; placing marks against the name of the child, which can be removed by good conduct afterwards, will be the direction in which minor punishments may take. But no boy or girl above fourteen should be submitted to personal chastisement, except for great moral delinquencies. I cannot agree to its abolition. The bench of magistrates with which I am associated is presided over by an amiable gentleman who is strongly adverse to the use of the birch, and in consequence the number of young urchins who were constantly in the hands of the police was very great. It was my duty to take his place sometimes, and after half a dozen of them were whipped at the police-station during his absence, there was at once a marvellous diminution in the number of little prisoners who were being brought up for punishment of crimes which they had been caught in the very act of perpetrating. A school in which corporal punishment is not often inflicted, but from which it is not absolutely banished, will be much more amenable to discipline, and will contain fewer prigs and bumptious individuals among its numbers, than will be found in a school in which corporal punishment is not allowed.

Corporal punishment should not be abolished.

Hysterical children to be carefully treated.

There is a class of children who are emotional, whose feelings are easily moved and easily shown upon the surface. They are the class from which our lunatic asylums are recruited, and public school life by its tendencies to repress emotion does much to diminish its incidence; a good whipping, administered soon enough, would have saved many a one from becoming a resident in a madhouse. A great point in education is to prevent a boy giving way to his feelings, to make him bear disappointment without emotion, and to face danger without flinching. Boys and girls who are emotional especially call for the careful supervision of the teacher, so that the evil tendencies in the system may be eradicated, and the future in life made much less likely to end in insanity.

CHAPTER X.

SCHOOL DESKS AND SEATS.

Bad position in writing, drawing, and standing in class, or sitting upon a simple form, are very prominent causes of deformity. Twisted spinal columns, malformations in chest, stooping habits and shuffling gait, with many kinds of bodily ailments, follow a want of knowledge by the teacher upon these points.

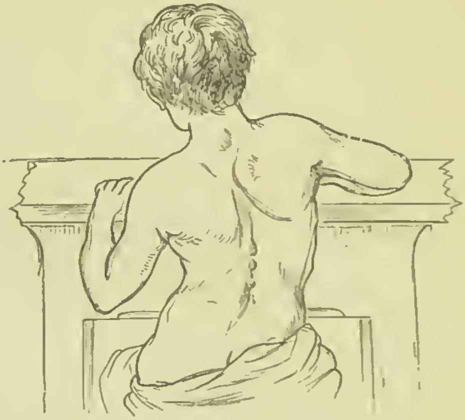


Fig. 19.

This result is shown in figs. 19 and 20, in which the lateral curvature of the spine (fig. 19), and the tendency to stoop, with high shoulders and contracted chest, is shown. Not the least evil is the influence

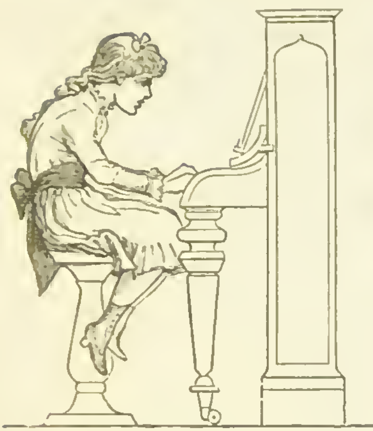
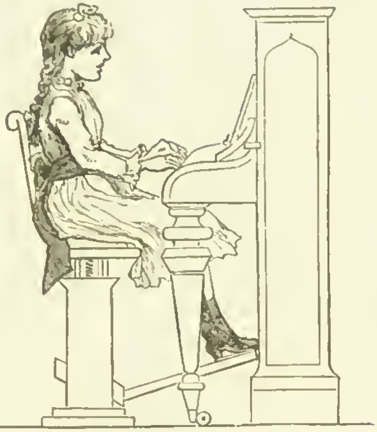



Fig. 20. (after Dr. Roth) Fig. 21.

which this indulgence in a wrong position has upon the eyesight. The bad construction of the seats and desks in ordinary use in all schools, has been a fruitful source of evil even in the great public schools of the country. The indulgence in right-handed work leads to malformation of muscles. It is therefore much to be desired that children should be encouraged to practise exercises of all kinds with the left hand as well as the right, and even to learn to write with the left hand in early life, certainly to draw lines and figures with both hands equally well; and to handle the bat and throw the ball first with one hand and then the other. It will be conducive to excellence in the end, by producing a perfectly-fashioned figure, and preventing the formation of irregularly-developed muscles, which are visible in most people that we meet in the streets of a great city. This applies to the small muscles as well as those of larger size, and in no case with so much effect as with the minute muscles which regulate the eyesight. The eyeball is

Right-handed work only should not be tolerated.

swung in a kind of sling, which is acted upon by six muscles. The custom in school life frequently appears to be to prevent the development of these muscles by saving them from exercise altogether. Children are allowed to bring the eye in close proximity to the paper or the book, to twist the spine so that one shoulder is brought down and the other elevated; the neck is so twisted that the axis of vision is perverted, and one eye being on a different level to the other, the set of muscles in use are not equally acted upon, so that one muscle gets to be stronger than the other. The axis of vision is irregular, and the child gets more and more SHORT-SIGHTED. The objectionable position is shown in figs. 20, 22, and 24. The correct positions at the piano and in reading and writing are shown in figs. 21, 23, and 25. The next error is that which so-called 'oculists'—perhaps I should say opticians—encourage: the child is made to wear spectacles, by which means the chance of cure is taken away. The eye is irretrievably

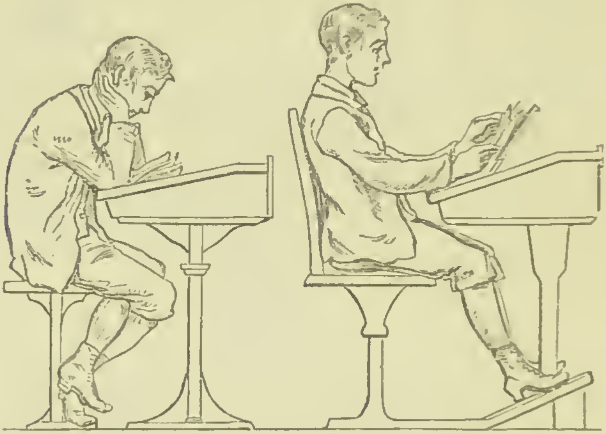
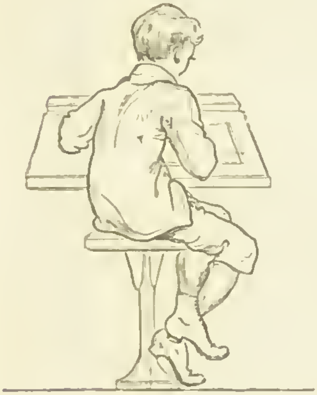


Fig. 22. (after Dr. Roth) Fig. 23.

Short sight a consequence of bad position.

Use of spectacles not to be encouraged.

damaged by this course. The proper means to be taken are to exercise the eyes by making the child use the muscles together, and in an equally continuous manner, by placing him at a small distance from a series of letters attached to a wall, and then causing him to step backwards a few inches at a time, and encouraging him to use the muscles by focussing the eyes so as to get those muscles to act in harmony, and to lengthen the distance at which vision is perfect.



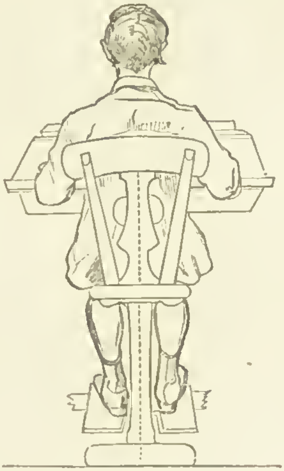


Fig. 24. (after Dr. Roth) Fig. 25.

Physical exercise necessary.

This is not the most easy way to overcome the evil, but it is the right way. To encourage the use of spectacles before the muscles are developed, is to prevent them reaching that position which they could do if they were physically exercised. If all the short-sighted children in a school were treated in this way for twenty minutes at a time every day, it would be found that the spirit of emulation would bring the muscles to equal and regular action, and the use of spectacles would be rendered unnecessary; that is, if the improper positions commonly indulged in at the desk were prevented by the class teacher. The difference produced by book education, on the one hand, and athletic and muscular development, on the other, is seen among fox-hunters and sportsmen who are innocent of cram at college, or of college distinction, and those who have been studious. In the one case the sight is natural, in the other spectacles are generally used.

Desks and seats must not be flat.

Desks must not be of an equal height for all children; they must be capable of regulation, so that a boy five feet high need not be obliged to sit at the same level as one four feet two. The taller boy has to stoop, or the shorter boy has to raise his head too much. The desk must not be too near or too far from the seat, and a flat desk such as figured in figs. 26 and 27 is a mistake. The desk should incline slightly towards the child, as in fig. 28. The feet should be supported by a foot-board, and there should be always a fairly curved back to the

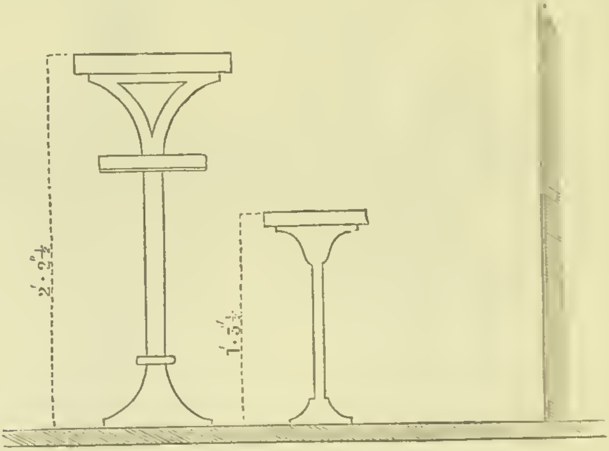


Fig. 26.

seat, so as to prevent fatigue to the child, and its natural consequence, a curve of the spinal column in the direction not intended by nature. The seat upon which the child sits should not be a flat surface, but somewhat saddle-shaped. It is discomfort which leads to deformity. Every effort should be made to obviate this, either by providing support, or by taking the child away from the desk at frequent intervals to exercise another set of muscles by another kind of action. Change of posture and variety of movement are the best remedies for those misshapen conditions which are fostered in badly-conducted schools. Such distortions are shown in figs. 19, 20, 22, and 24. The effect of proper drill is easily seen in the soldier. There is no muscular deformity to be seen in the ranks of the army; that which is effected in the army could be much more easily achieved in the school playground, if a little attention were daily given to this subject. I am not advocating luxurious habits in reading and writing; fatigue should follow upon all work, but when the fatigue comes it is best to change the character of the occupation, and not allow it to go on in the same groove for too long a period. If this change of occupation is carried out properly, the position of the child is not of so much moment; but it is best for him to sit erect when writing, to keep the eyes in a parallel line with the surface of the desk (*vide* fig. 23), the shoulders at an equal height, and the elbows close to the side, and not resting upon the desk itself. Weakly and delicate children should have a support for the whole of the back (fig 25). The fittings suggested by authority of the Committee of Council on Education, are very defective in this matter (figs. 26 and 27). The area suggested by the Council may be convenient for the supervision of the teacher,

Change of position.

Fatiguo obviated by change of position.

but it is much too cramped; convenience for teaching is not the first thing to be considered. The benches are made quite flat without backs, and scholars are grouped according to their standards in the classes, tall and short children sitting upon similar seats.

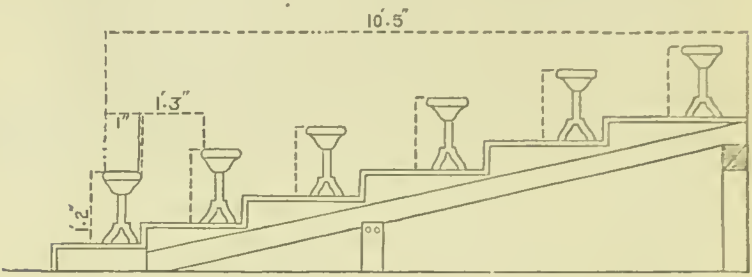


Fig. 27.

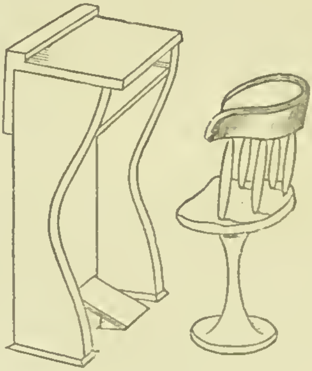


Fig. 28.

The iron pedestals are screwed to the floor to fix them. The galleries suggested for the juveniles, as shown in fig. 27, may do for massing, but not for health and muscular development. The seats should have backs, and the stools be capable of adjustment to the length of the scholar's legs (fig. 28), and the desks sloped towards the child, and not flat. For those who can afford to provide the best kind of seats, I can recommend Dr. Roth's hygienic chair (fig. 29), or Messrs. Hodgkinson & Clark's adjustable desk, which is suitable for any age from six to sixteen, and so arranged that curvature of the spine, compression of the chest, and high shoulders are guarded against as far as they can be by school furniture. The seat can be raised or lowered, and the desk advanced or thrown farther away, to suit the physical development of the child. A figure of this 'Davenport' is shown in the *Sanitary Record* for April 15, 1884.

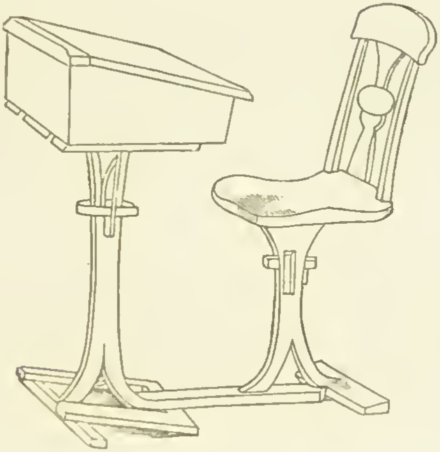


Fig. 29.

Bowditch's observations.

Dr. Bowditch, of the Havard University, U.S.A., has made some observations based upon the measurements of 25,000 children, which is published by the State Board of Massachusetts for 1884. He tabulates the growth of the scholars, and finds that it varies greatly in different periods of school life.

That up to the age of eleven or twelve, boys are taller and heavier than girls. The latter then begin to grow more rapidly, and soon surpass the boys of the same age in both height and weight, but after thirteen the boys catch up the girls and surpass them. The relation of weight to height was found to be such that at heights below 58 inches, boys are heavier than girls in proportion to their stature; but that at heights above 58 inches, the reverse is the case. Local hygienic conditions have considerable influence on the physique of growing children, and the sanitary condition of a population may be discovered by an examination of the children in the elementary schools of the district. The observations of Dr. Bowditch point to the necessity for classification in accord to other matters than mere age or standard.

CHAPTER XI.

SCHOOL COSTUME.

Miasms from old clothes.

School uniform.

THE kind of clothing to be worn by school children is a part of hygienic knowledge, which it will be right to consider. The atmosphere of an elementary school on a wet morning is at times most sickening. The woollen clothes having been worn for months, or even years, are perspiration soaked, and they reek with unhealthy miasm. The miasmatic exhalations continue until the clothes of the children have become thoroughly dried. If the morning is chilly, the cold air being excluded by the sensitiveness of the master, a most explosive atmosphere is developed, capable of fecting all the susceptible constitutions in the school, if a case of measles or scarlatina in the incubative stage, and about to break out, happens to be included among the scholars. I think it is important that in all large schools there should be a cloakroom, in which a school uniform should be kept for each scholar; in this room the pupil's out-of-school attire could be left until the school work is completed. The child's own dress could be dried by heat, the cloakroom being capable of conversion into a hot-air chamber when the atmosphere is extra damp. The uniform might be quite simple and light; it should consist of linen in summer, of woollen in winter, and should be provided by the parents as a part of the school outfit, unless the parents are absolutely poor, in which case the State should provide it, as well as the desks and forms at which the scholars sit. A senior boy or girl should be cloakroom monitor in turn, to see that each article of clothing is in order. He or she should be provided with needle and thread, tape, buttons, scissors, and other articles belonging to an ordinary work-basket; the monitor or monitors seeing that the clothing is kept in good order, and, when defective, that it be repaired sufficiently for the purposes of propriety and modesty. I suggested this plan many years ago, at a meeting of the Social Association at Glasgow; its financial aspect was the cause of antagonism by school managers; but if we are to raise a nation of healthy men and women, it is a necessary part of school education.

Dress drill.

Every school should have its lavatory, in which even day-school children may be compelled to wash the hands and face, and brush the hair, so as to make ready for the dress drill every school should be required to perform once or twice a week in turn in the different classes, five or six classes being formed for the purpose, and one class drilled in this direction once a week at least. Brushes and combs must be provided for this purpose, and be kept clean by the cloakroom monitor. This drill should be a part of the school work, and excellence in it should be a part of successful education, those children who come to school dirty being sent to the lavatory for cleaning.

School caps to be worn in public streets.

Children in particular schools should wear a special kind of cap, capable of being recognised when the child is in the public street as well as in the playground. This would lead to identification of misbehaving; not, however, a mortar board, or other ridiculous emblem, but a simple cap with a particular band, and made of soft, flexible material, without peak, but with a broad brim behind. The jacket or coat should be loose in every part. The skeleton suits of corduroy are very lasting, and are warm, but usually fit too tight. A simple blouse for boys, like to the French workingman's dress, is the most suitable, with trousers to match, of cotton or linen for summer wear, those articles being good conductors; whilst the winter dress should be of coloured flannel or cloth of some kind, woollen articles being bad conductors of heat, and keeping in the warmth of the body. There must not be any bands round throat or waist which are at all tight. The female should wear a garment of similar material, something like to Lady Harberton's one garment, but as simple as possible. The trousers or petticoat should be suspended round the hips, and not, as is usual now-a-days, by a tight band above the hip bones. The band should be elastic, and placed inside the trousers, with a linen flap a little below it, fastened a little below the left hip; the pressure is then brought over the hip bones, above the swelling of the head of the thigh, instead of round the waist. This is the position in which sailors attach their trousers, and they never require the braces which less active men are so much accustomed to wear. The drag upon the shoulders is got rid of, and the chest is left perfectly free for its respiratory movements. The same kind of band is best for girls' petticoats to be suspended about their hips, and on no pretence whatever should stays or waistbands be allowed above the hips; garters are not to be tolerated, but those who wear stockings should keep them up by suspenders attached to the petticoat or trouser band.

Tight bands to be prohibited.

Lower garments to be suspended from the hips.

As regards boots and shoes, it would be an advantage to healthy development if they could be dispensed with in all elementary schools. The feet of the poorer classes, as shown in the London hospitals, are marvels of monstrosity. It is not often that a child born of poor parents in London has a well-shapen foot, in consequence of the custom of making the foot conform to the shape of the boot, instead of the boot being fashioned to fit the foot. Scotch, Irish, and Welsh children have the best formed feet. These are seen sometimes in hospitals, when they have come to London as adults, not having worn shoes whilst they were children, except on rare occasions. The Scotch children in country places run about without any covering to their feet, the granite roads not hurting them in the least; and they are as little susceptible of cold as other people would be, as regards the hands, if they do not use gloves. It is habit alone which causes people to feel the effect of cold to the feet; but I think the custom has too great a hold upon the people now to be altered by school hygiene, and we must advise in this matter for things as they are. Boots and shoes will be worn, and it is requisite to describe them as they ought to be. The sole of the boot should be shaped according to the natural line of the foot. The inner border from the heel to the point of the great toe should be nearly in a straight line. There must be room in the boot for the toes to spread out. The outer side of the covering being somewhat rounded; as in fig. 30, they should always be rights and lefts. The heel should only be indicated by a thicker part of leather to the extent of a quarter to the third of an inch; the high heels so much in vogue are antagonistic to a well-formed foot, causing the toes to press against the toe of the boot, producing corns and bunions. These excrescences are unknown to

Boots and shoes as they ought to be.

Rights and lefts.

those who do not use upper leathers, and well-shapen feet are necessary for fleetness and excellency in athletics. The feet should be washed every day as naturally as the hands and face. The stockings or socks should be woollen in winter, and may be cotton in warm weather. They must not be tight, but fitted to the proper length of the feet. Every child should have a pair of light shoes at the school to wear in the classrooms, leaving their heavier boots in the cloakroom with the overclothes. Each child should have a numbered hook for suspending the various garments, and a ledge upon which the dirty boots may be placed. The neck should not be encased in comforters or any other kind of wraps; such things lead to delicacy, not to strength of voice. Sailors never clothe up their throats, and as a consequence are not troubled with mischief in that organ, or those losses of voice which is especially the outcome of too much carefulness. Finally, everything tending to stay the natural growth of the body must be cast aside, if we wish to have a nation capable of defending ourselves from foreign aggression, or holding our own in the arts and the sciences belonging to industrial life.

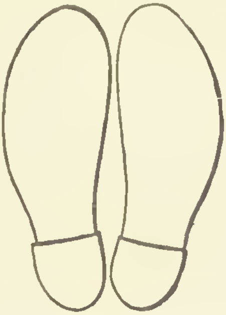


Fig. 30

CHAPTER XII.

THE OBJECTS TO BE ATTAINED BY EDUCATION.

Objects of education.

It will not be out of place, in concluding this part of our subject, to ask a question upon the object to be gained by education. This is but too often misunderstood by managers of elementary schools, and the course of teaching not such as is calculated to produce a race of healthy men and women, physically fitted for the duties they will have to perform in adult life. Boys should be taught to use their hands, and to educate their individual muscles by industrial work. The want of proper training in youth in industrial handicrafts and technical arts on the part of boys, and household work on the part of girls, is lamentably deficient in our present plan, and is striking at the root of our national advancement. Book knowledge is not the knowledge which is of the greatest importance to the masses of the people. It is immaterial to a boy as to whether Thebes had a hundred gates, or as to the method by which Alexander cut the Gordian knot; but it is of the utmost importance to the embryo carpenter that he should be able to work the individual muscles of his thumb and fingers aright, and to the girl that she should be able to make a dish of soup for her future husband without spoiling the meat. Boys and

To inculcate knowledge of common things.

girls are being taught in school that handicraft is menial work; and the use of tools in school education is altogether ignored, as if cricket could be taught from a book without practice at the wicket. We are leading the growing population to believe that bread gained by sedentary employment is more honourable than that which is obtained by the sweat of the brow, and that mechanical quill-driving is of a higher order than mechanical work. Industrial and technical training must be introduced in our elementary schools instead of advanced book knowledge. The latter is a luxury, the former is a necessity. Indulgence in the luxury will lead to the loss of power to obtain that which is necessary. In the words of Lord Brabazon, I may say that 'The country wants handicraftsmen, and we give them scriveners. The colonists are crying out for men who can plough or mend a cart; we send them clerks with black coats, and persons unwilling to soil their hands. Our farmers and working-men want wives who can cook, bake, and wash,—those who understand a dairy and the management of poultry; and we send them young women who can play the piano, and pretend to talk French, and know the distance of Jupiter from the sun, but they know nothing about the things that are most required in common life.' This is not healthy, it is not hygienic, and requires earnest consideration at the hands of our sanitarians and educationists.

Technical training necessary.

Lord Brabazon's views.

Some of the evils arising from a cultivation of book knowledge rather than handicraft work, is due to the vicious side of the principle established when payment by results was made the rule in board schools. This course is based upon financial rather than correctly educational considerations. Though excellent in its first bearings, it is also anti-hygienic.

Payment by results anti-hygienic.

The classifications in schools are not regulated by the excellence of the scholars in technical study and bodily development, but are directed to attain the highest percentage of passes. Such results are misleading and fallacious, encouraging cramming rather than a fundamental knowledge. The dull scholar is placed upon the same base as the child with a rapid intelligence; and the boy who would make a splendid mechanic, is depressed and discouraged by failure, or lured on in a path which is not the best for him to follow, because the teacher's principal object is to get him into a higher standard by efforts of the memory alone. This is a fault of great importance; and whilst agreeing to the basis of payment by results, I would suggest that the finest steel and the sharpest blade is not required to square a granite sett, and the waste of teaching power which now takes place should be remedied by a better classification, and the introduction of technical education made a *sine qua non* for using Government aid, whilst muscular development and personal cleanliness should also be a factor in determining the result.

PART II.

CHAPTER I.

SCHOOL SURGERY.

It is proposed to consider our subject under three heads, all of which are connected with a departure from a proper condition of health, and may be common to all schools, requiring immediate attention on the part of those in authority. The departures may be general or particular; may apply to considerable numbers of children at one and the same time, or be personal only, to one or more, as being caused by one's own or another person's act. The measures to be taken by the teachers have reference to the prevention of disease or accident, as well as to the removal of their incidence when they do arise. They separate themselves into *School Hygiene*, or measures connected with the subject of infectious disease; *School Surgery*; and a less important division, which includes simple instruction upon *Medicine*, and is connected more directly with disturbances of health, especially those which are trivial and do not require medical attendance.

School Hygiene includes a consideration of the measures requisite to prevent the admission of infec- **School hygiene.**

tious diseases, to prevent their extension when they are unfortunately admitted, and to remove them from the precincts of the school as soon as possible after admission, so as to avoid the necessity for closing the establishment altogether.

School surgery.

Under the head of *School Surgery* we shall consider the accidents which more properly belong to school life; and also the emergencies which are of frequent occurrence, and which render a knowledge of the principles which ought to be followed absolutely necessary on the part of those in authority, so that no mischief may be done before the surgeon, who may have been summoned, can possibly appear upon the scene; and lastly, we have the simple principles of household medicine, which should be known to all men and women who are heads of establishments, and especially to those who have a number of young people under their care.

School medicine.

Nimia cura medici, which some people are supposed to require, and which uneducated people too often indulge in, does more harm than good. A knowledge without prudence, a zeal without discretion, and a theory without practice, are all bad; but they are especially so in the arena which belongs to the properly educated medical man. It follows, therefore, that nothing is put forward here which is intended to supersede the necessity for medical advice when it can be obtained, but only to provide for emergencies when no doctor is at hand, and when attention is wanted immediately, or in which it is important that the school authority should know how to act when such emergency does arise, and when action must be immediate.

Not to supersede medical man,

but to be usod before his arrival.

These rules are based upon those which every properly educated medical practitioner will be sure to follow upon his arrival on the scene, and there will be so much time gained, either in preventing mischief from accident, or in arresting the progress of infectious disorder by taking time by the forelock, and preventing altogether the necessity for further medical aid, 'Prevention being better than cure' on all hands, and no body of men recognise this more fully than the honest-hearted medical practitioner.

School Hygiene.—The conduct of masters regarding infectious diseases requires more consideration than it gets at present. The difficulties which are daily arising in all parts of the country from a neglect of proper rule, is such as justifies early attention to this part of our subject.

Infectious diseases.

No child should be allowed to come to school who is personally suffering from any of the ordinary infectious diseases. They are measles, scarlet fever (or scarlatina, as it is often called), diphtheria, whooping-cough, mumps, small-pox, chicken-pox (or glass-pox), scald head (or ringworm), purulent ophthalmia, and scabies (or itch).

If the school be a boarding-school, any child suffering from any of these diseases must be at once removed from the school, and all those who have been in contact with that particular child for the preceding twenty-four hours should be put in quarantine,—that is, to be kept separated from the rest of the school. No children should be allowed to return to school after recovery from any of the above diseases until after they have been thoroughly disinfected, and after the lapse of a certain period, which should date from the termination of the fever stage. This disinfection must include a proper bathing of the whole body in some disinfecting fluid, such as a weak solution of Condy, or water in which some

Rules to be observed before returning to school.

chlorinated soda has been mingled. If the whole body is well sponged over with some water containing 1 per cent. of Condy or chlorinated soda, and then well scrubbed in a bath (temperature 85°) with some oatmeal, the whole of the infecting matter on the body may be rapidly removed. It is requisite to cut the hair, and then to wash the head first with the disinfecting solution, and then with some water, to which a little borax has been added; half an ounce of borax in a quart of water is a cleansing solution which will dissolve particles of epithelium, and prevent them from clinging to the hair, to the danger of the child's fellows. The nails, both of fingers and toes, should be cut, and the ears washed out; and if the process of washing is repeated every day for a week, there will be but little chance of danger to other children from that particular cause, provided there are no eruptions and no discharging abscesses or other sequences of the disease itself upon any part of the body; these are generally found at the alæ of the nose, behind the ears, or near to one of the orifices of the body. They should be all cured before the child is re-admitted to the school.

Medical certificate.

Where possible, a medical certificate should be produced, which should state that the child is free from infective power; but if no certificate is forthcoming, a child should not be admitted into school until three weeks after recovery from measles, a month after scarlet fever, at least six weeks after diphtheria, three weeks after mumps, a month after small-pox, provided all scabs have disappeared in that time, and nearly as long for chicken-pox. No definite time can be fixed for whooping-cough, and it is doubtful whether, if it be in a given neighbourhood, it can be excluded from a large school, but no child actually whooping should be allowed to stay in the school.

Ringworm.

Ringworm, or scald head, arises in the majority of instances from want of washing. If such cases appear in any school, all the children should have their heads well washed with soap and water, and afterwards well sponged over with a solution of borax,—an ounce to a gallon of warm water should be about the strength of the solution,—whilst those children who have the disease manifestly present should be kept at a distance until the places are perfectly well. It is right, however, to state that a large number of cases which are called ringworm are not the true disease. The real ringworm is characterized by the presence of a vegetable growth in the epidermis. A microscopical fungus, styled the 'trichophyton,' produces one form of true ringworm. The agents are either isolated spores or jointed filaments, which attack the scalp and grow in the hairs and their sheaths, and also amongst the epidermis of the scalp and other parts of the body. There are several kinds of these parasites which produce disease in the hairy structures. They can only be cured by plucking out the diseased hairs, cleansing the patches first with soft soap, then with solution of borax, and lastly applying equal parts of sulphurous acid and glycerine. The parasitic diseases include various forms of tinea, and are scarcely to be distinguished from harmless patches of tetter or simple lichen, except by the expert. The worst form of infectious ringworm is that which is styled 'tinea favosa.' It is produced by a fungus called 'trichophyton tonsurans;' it is at once known by the presence of yellow, cup-shaped crusts on the scalp; it is highly infectious, very difficult to cure, and on no account should a subject of it be admitted among other children. It is always a mark of badly-nourished, badly-fed constitutions, and associated with filthy habits and bad hygienic surroundings.

Cleanliness of head necessary.

Brushes and combs.

Head drill in elementary schools.

Cleanliness of head is a necessary contingency in all schools, so that the chance of infection may be avoided. All large schools should have a place in which the hair should be combed and the head properly cleansed as frequently as may appear necessary. The operation should be superintended by a monitor or person appointed to see its due execution; a senior child in turn should take this duty under the control of the teacher. The brushes and combs in use must be kept clean, and each child restricted to his own articles. In elementary day schools it would be good practice to have occasional inspection drill as regards the children's heads. I am sure it is far more important to teach children the necessity for clean heads than for nine-tenths of the tasks which are done in the school hours, and yet I am not aware of a single day school in which such an inspection drill exists. It would assist the master or mistress very materially in their work by checking irritation caused by parasites, and assist very much in diminishing the incidence of infection at any rate as regards diseases of the scalp.

Ophthalmia.

Scabies, or itch.

Purulent or infectious ophthalmia is a very troublesome disease, and when it has obtained hold in a school it is very difficult to eradicate; personal attention to each case and rigid isolation will alone effect its removal, whilst it often happens that much injury is done to eyesight in consequence. The disease which is called scabies, or itch, is not uncommon in some elementary schools; it is not usual to take much notice of it, but a child who is the subject of it ought not to be admitted into any school until he is cured. This is not a difficult matter; it can be effected in three days if the disease be vigorously attacked. It is due to a small insect somewhat like a cheese-mite, which burrows in the epidermis and lays its eggs, the hatching of which gives rise to the itching from which the disease is named. Sulphur is fatal to the insects themselves, and if used by inunction, so that the canals leading to the nests of the insect get filled with the sulphur itself, the young brood are destroyed as soon as they change their state from ova to developed acari, whilst all the insects which have been previously hatched, both male and female, are at once destroyed by contact with the sulphur.

Rules for those coming from infected houses.

The preceding observations apply to children who are suffering or have suffered from infectious disease; but it may be that the child is not himself affected, but is living in a house in which some one else is suffering from infectious complaint, and that child may convey the disease to his school-fellows. No child should be allowed to attend school under these circumstances. The rule, however, may be somewhat relaxed in the case of children who have already had an attack of the same kind of disease at some anterior period, say in the preceding year, provided they are kept from all immediate contact with sick persons until the recovery and disinfection are complete. It may also be relaxed in the case of those children who, not having themselves had the disease, have not been in contact with the case and have been at once removed to an uninfected house; or if they have been in contact with the case, then a fortnight's quarantine should be established, which will clear them all from the possibility of becoming the subject of infectious complaints if they have escaped infection on that occasion. Children are frequently sent to school whilst suffering from an infectious disease which had not been recognised because extremely mild, or in its very early stage, or, as too often happens, because the parents are careless as to other people, and won't take the trouble either to verify their suspicions or even to prevent mischief when they know that it is likely to happen. The teacher or director of every school should, therefore, give immediate personal attention to any child who may appear ill or complains of feeling unwell. Feverishness should lead him to suspect the presence of infectious disease, and if the teacher could be provided with a thermometer, such as is now in common use among medical men, he need never be in doubt upon this head. If the feverishness is combined with any kind of rash upon the skin, or with any appearance or complaint of sore throat, or with both, he need be under no difficulty as to the advisability of that child leaving the schoolhouse as soon as possible. The thermometers are provided by all the surgical instrument makers, and are of very simple construction; they have an index which registers the highest temperature. If this is placed in the axilla or armpit of the child, so that the mercury in the bulb is kept in contact with the skin at the deepest part of the axilla for five minutes, it will register the highest temperature. If this exceeds 100 (the normal being 98·5) it is evident that the child should not be at school at all, and should be sent home at once, or if it be a boarding-school, the child should be put in quarantine.

If in doubt, use thermometer.

Duty of principal of school if infectious disease breaks out among his pupils.

I am frequently consulted as to the duty of the principal of a boarding-school when infectious disease has suddenly appeared among the boarders. To my mind, the duty is clear. The principal should immediately find out which of the children have been recently in contact with the case by sleeping in the same dormitory, or by being in the same class, or in any way in close contact with the sick child. Then find out who among this number have not previously had the disease in question. Put all these in quarantine immediately. Inform the parents of the affected child that the child is ill, and as soon as may be convenient he should give information to the parents or guardians of all the children that such a case has appeared in the school, and that the manager has taken the necessary precautions to prevent the extension of the disease. It is a great mistake to keep the fact a secret from those most interested ; and if the parents are made aware of the rule of the school when a child is first sent to it, they will be much more content and less suspicious than if they are kept in ignorance of the outbreak, whilst a serious responsibility is removed from the shoulders of the principal or manager, which responsibility he has no right to assume. If the cause for the introduction of the case can be proved to be by means of personal contact, the spread of the disease may be checked at once. If this is not a doubtful point, it follows that in all probability there will be no extension beyond that which arises from the danger which those in quarantine may have fallen into. The quarantine must be kept up as long as may be necessary to clear the children from the suspicion of having contracted the disease. If the cause of the outbreak is in the school itself, it must be removed, but to do this it becomes necessary to find out from where the cause proceeded. If cases continue to occur in a school in which the course above recommended has been adopted, there is always reason to suppose it may have a local origin. It will be only right to consult an expert as to its possible cause, and especially to get into communication with the medical officer of health of the district in which the school is situated. Indeed, it is always right to inform this official of the outbreak immediately it arises, and to take his advice upon it. It is certain that in the course of a short time this course will become a compulsory duty, and its neglect will involve severe penalties; and as such is sooner or later likely to be the law of the land, it will be best to get into the way of it, and do that from choice which will soon be one of necessity. This is now the case in a large number of large towns in the kingdom. There is no plan which will be more conducive to the interest of the schoolmaster than this action of the Legislature. It will enable the master to know from whence the disease has been imported into his household, and to trace it backwards to its source, and by that means give him a just ground for complaint against the author of his misfortune, if it has had an origin from without. I press this side of the question very forcibly upon all who have infectious disease introduced among them; it will be of greater benefit to school managers and school proprietors than to any other class of persons, especially if the case is one of scarlet fever or small-pox, for these cases do not crop up unless there has been contact with a preceding case of disease; they do not suddenly put in an appearance without connection with some preceding case, and isolation must be immediate to prevent further mischief. This isolation may be carried out by removing the patient to the top of the house and entirely shutting off immediate communication with the rest of the establishment, or, better still, by removing the child to a separate cottage, where there

Communicate with medical officer of health.

Each case has been proceded by another somewhere.

Isolation required.

can be the most perfect quarantine. The greatest danger of infection from these cases is during the fever stage, when it is probable that the exhalations from the patients are themselves infectious and incapable of being disinfected with that certainty which can be carried out with the *débris:* infective particles are particulate in their character, and are usually wrapped up in some epithelial matter. It is necessary to freely disinfect the excreta which come from the patients immediately upon discharge. This is easily effected by receiving them into a vessel containing a strong solution of persulphate of iron (green copperas) of a strength equal to an ounce to the gallon, or into a bed of dried earth, such as an ordinary earth-closet supplies. It is not difficult to prevent the spread of infection during the convalescent stage, because the breath then ceases in a great measure to be infectious, and our efforts may be directed to the disinfection of the *débris* and of the articles of clothing which have been worn by the patients as well as of the bedding which has been used. These may be completely purified by exposing them to a dry heat of 330°, or by plunging them into boiling water and keeping them at 212° for a few minutes.

Scarlet fever. A scarlet fever patient should have the body anointed daily with pure salad oil in which camphor has been dissolved, in the proportion of one dram in two ounces of oil. **Small pox.** If the case is one of small-pox it is better to use animal charcoal finely powdered instead of camphor. If mixed in such proportions as will make a thin paste, and applied to the patches of eruption, it will prevent the pitting, and probably also prevent the fertility of the germs contained in the secretion of the pox; for I think it is now established on a perfectly sound foundation, that these diseases are propagated by the dispersion of minute atoms of perverted protoplasm, which retain their vitality, and are capable of germinating in suitable soil so as to reproduce their kind. These vital germs are allied in character to the fungi on the one side and the algæ on the other, and they require for their propagation some of the conditions which belong to both; light and ozone are antagonistic to their reproduction, and, with free motion of the atmosphere, are the agents which are antagonistic to the maintenance of their vitality, and it is upon these agents that the principle of repression or stamping out infectious disease depends. Introduce light into the places which have been occupied by fever patients of any kind, ventilate freely with atmospheric air, and supply ozone as abundantly as possible, and it is quite certain that in a short time there need be no danger of the spread of infectious diseases among children or any other classes of persons.

Typhoid or enteric fever.

Typhoid fever is much more amenable to repressive measures than either of the two former diseases. It is scarcely infective at all, except under very exceptional conditions. It is sometimes called enteric, sometimes gastric, low or continued fever. It is more often caused by a water supply contaminated by sewage than by any other means. Whenever a case arises in any school, it is incumbent upon the managers to look to their source of supply, and inquire narrowly into the possibility of contamination from some one of the many causes which will now and then crop up in the best regulated establishment. Recurring cases must be traceable either to water or milk, or some other article of food, or to a want of sewer ventilation. It is due to these causes more certainly than to personal communication. In any case consult the medical officer of the district. Immediately disinfect the

Rules for all cases of infection.

excreta of the patient. In all cases of infective disease, remove all curtains, carpets, and every kind of cloth from the room which is occupied by the patient, for those articles absorb the *materies morbi*, and may give out again to somebody else; and the most perfect cleanliness of all persons who come in contact with the sick must be insisted upon. Daily fumigation of the sick room and of the house in which infectious disease exists, should be carried out by burning some brown paper or woody matter and sprinkling carbolic acid with water in the form of spray. A very elegant way of fumigation, and a very efficient means for removing smell, is by burning some ground coffee upon live embers taken from a fire, and held in the middle of the room upon an ordinary shovel. A few spoonfuls of coffee burnt in this manner give a very agreeable odour, and effectually remove all disagreeable smell in a very few minutes. There is one other important matter which it is well to notice. No attendant upon a sick person should ever take food in the sick person's room. It is running a risk, which it is the duty of the principal to prevent, by providing that the nurse shall have a room for feeding in, which shall not be the one occupied by the patient. I refer my readers to the preceding chapters for further information upon points more immediately connected with personal hygiene.

CHAPTER II.

ON WOUNDS.

THERE are many dangers which naturally belong to schoolboys, and which, if attended to at once, are not likely to lead to mischief, but which, if neglected, may lay the foundation for constitutional diseases, and often lead to the loss of limb, or even to life itself.

It is very common for children to bark themselves, as it were, in running, or in any kind of boisterous game; they fall down upon a gravel path or other rough ground, and produce simple *abrasions* of the skin, or a *contused wound* may be produced, or the cut may go deeper, and be really *incised*. In abrasions there is simply the removal of the cuticle; contusions have bruises which extend to a deeper part of the cutis, whilst in incised wounds these cuts are more or less deep, and more or less clean. *Lacerated wounds* are those in which the parts are more or less torn, and these, with the class of *punctured wounds*, are by far the most dangerous; and lastly, there is another dangerous kind consisting of *poisoned wounds*, which require to be considered each in detail.

Treatment of abrasions.

(1) *Abrasions.*—These require to be cleared from the dirt and gravel which they may contain, and they should then be preserved from contact with the external

air as quickly as possible. The simplest way treat to these cases is to cover them up with a slip of lint soaked in Friar's Balsam, or Compound Tincture of Benzoin, as it is styled in the 'Pharmacopeia.' The application produces a slight smarting, which soon goes off, and if the child's blood is in a moderately healthy state, it will heal rapidly. It is not well to bind up too tightly; apply the lint and bandage only so that it may be kept *in situ.*

Treatment of contused wounds.

(2) *Contused Wounds.*—A similar treatment is all that is required; it is not necessary to stay until all bleeding has ceased, but as soon as the place is properly cleansed, put on the Friar's Balsam, and cover it up from the atmosphere, and allow the dressing to remain on for some days, unless the place should become hot and painful, in which case a poultice should be applied to soften the dressing, and the rules of treatment somewhat altered, as will be described in considering lacerated wounds.

Incised wounds.

(3) *Incised Wounds.*—The treatment will depend very much upon their extent. The old custom of sewing up cuts of this kind is best when let alone, and not followed. There is seldom any requirement for such an operation. The wounds are frequently accompanied by serious hæmorrhages consequent upon an injury to an artery or a vein. The injury to an artery is a very serious contingency, and the services of a surgeon should be obtained as rapidly as possible. In the meantime the hæmorrhage must be arrested, by pressure applied in the right manner. Hæmorrhage from a vein is at once stayed by the gentlest pressure; the blood is dark in colour, and flows in a continuous stream. Not so that from an artery; it comes out of the wound in jets, which correspond with the pulse, and has a bright scarlet colour. Hæmorrhage from a

Injury to blood-vessel.

vein is easily restrained by the finger pressing gently on the wounded part; or if it be a large vein, by a firm pressure or ligature applied below the wound; if the cut is upon one of the limbs it generally ceases in a very short time. The bleeding from an artery is continuous in spite of gentle pressure, and can only be stayed by a ligature tightly pressed upon the artery which supplies the limb, which must be applied above the wound between the latter and the heart. Suppose it is the artery in the wrist which is cut, the ligature must be applied tightly above the wound between it and the elbow, but if it is the vein, then gentle pressure upon the cut will be sufficient to arrest all flow in a few minutes. Sometimes it is necessary to make very steady and strong pressure upon a bleeding artery. This can be effected by tying a handkerchief tightly around the limb, using a cork as a means for obtaining due pressure directly upon the artery, and increasing the pressure by a stick which is inserted between the handkerchief and the limb on the opposite side to the wound, and twisted round so as to completely stay circulation through the artery, and which should be kept up until the surgeon arrives.

Divided or punctured artery.

It will be all but useless to strap up or bandage a wound in which an artery has been divided; any attempt therefore to do without skilled surgical assistance would be attended with serious danger to the life of the boy. The surgeon, as soon as he has made out the position of the wounded artery, will enlarge the wound and place a ligature on it above and below the part injured. If it be a small artery, a ligature of the upper portion and so-called torsion of the lower may be sufficient. The lips of the wound will be brought together and treated just the same as if no ligature had been used. The cut surface may be anointed with carbolized oil, and some antiseptic lint or gauze applied and kept in its place by a bandage. It will be found that if this has been skilfully applied that there is no suppuration, so-called—that is, that there is no pus or matter formed, and the wound heals by first intention (another surgical term which in effect means without suppuration), the child is well in a few days, provided the injured part is kept at rest and not allowed to be damaged in any other manner. The ligature comes away in a few days, and is no detriment to the healing process. Clean incised wounds, in which there has not been any injury to an artery, are easily dealt with and soon get well. If they are dirty they must be well cleansed with pure water, so that all foreign bodies (that is, all extraneous matter) may be entirely removed, then apply carbolized oil freely, bring the lips of the wound together by narrow strips of adhesive plaster, and cover up with antiseptic gauze.

Lacerated wounds.

(4) *Lacerated Wounds.*—These never heal by first intention; the torn parts contain damaged tissue, which is sure to die, and must be removed from the injured part before the flesh will heal and the skin cicatrize; but if the laceration is not severe it may be treated as directed for contused wounds. Lacerations of the fingers and toes, such as are produced by rusty nails and jagged iron on park palings and similar fences, are sometimes followed by very serious results, though the wounds themselves may not appear at first to be of much moment. Skilled assistance should be immediately sought for in any such case, and in the meantime it is best to bathe with warm water for a short period, or until the surgeon comes, and then cover up from the air. It used to be a custom to push pledgets of lint into such wounds to

keep them open; all these kinds of insertions are injurious: indeed, it is never right to put foreign bodies, except ligatures, in fresh wounds under any kind of pretence. Bring the parts into as natural a condition as can be done, and keep them so by gentle means; all tight bandages and all closely fitting compresses are wrong; antiseptic gauze gently applied may allow of a great part of the mischief being repaired without the production of any constitutional disturbance. By the term constitutional disturbance is meant the reaction which is set up in the system after the shock of a wound of any kind. A moderate amount of local inflammation is necessary to heal a wound in every case, but if it goes beyond the locality, then the action is said to be constitutional; and if increase of heat results—which is a kind of fever—it shows that the mischief has gone beyond the line necessary for the healing process to be completed. This constitutional disturbance may run high in those suffering from the effects of lacerated wounds, especially if they are so-called inflammatory subjects,—that is, if they have been accustomed to take much animal food and drink alcoholic liquors. The total abstainer, if he is also temperate in the use of flesh meat, is seldom, if ever, inflammatory, and his wounds heal by the first intention in a most convenient and comfortable manner, even lacerated wounds giving but little trouble.

Their treatment.

Parts quite separated cannot unite again.

Sometimes a finger is torn off completely, and an inquiry is made as to the possibility of obtaining a reunion of the severed parts. Reunion in such a case is not possible; but if there is any part remaining attached it should not be separated until the surgeon has determined whether it can be saved or not. A small attachment will be sufficient to keep up vitality in the case of a clean incised wound; but if the part is lacerated, the retention of vitality in the separated part is not likely to ensue. The constitutional disturbance which a lacerated wound sets up is to be met by simple diet and warm applications to the wounded part. The employment of warm water to the part affected by means of lint under oil silk is the most comforting. This should be frequently changed, and occasionally, as inflammation comes on, it should be applied cold, to test the comfort. It will be found that sometimes warmth is most soothing, at others the application of cold water is most grateful to the patient, and in all these cases the feelings of the patient may be consulted, and that application used which he finds most soothing and most grateful. Some cooling aperient should be given if the bowels are confined and the appetite indifferent; this may consist of a little citrate of magnesia or a teaspoonful of some other aperient saline in warm water. If suppuration arises,—that is, if pus or matter forms in the wound,—a poultice of bread and water or of linseed meal may be applied with advantage, but these must be made in a proper manner, and not in the way in which I occasionally see them done, even in clever people's houses. Skill is required in making a poultice, as well as in every other simple work. The best method of making poultices will be described when discussing the treatment of abscesses. The position of a wounded part should always be such as is most comfortable to the patient. It is a serious error to place it so as to be irksome. Ease should be studied, provided that ease is natural. If it is only found in an unnatural position, it is wrong and must be fought against, and in the course of time the unnatural position will be overcome and ease found

Suppuration or formation of matter.

in a more satisfactory posture. When ease is obtained in a position which is unnatural, there is mischief going on somehow which must be obviated.

Lockjaw.

Lacerated wounds are sometimes followed by lockjaw, or tetanus, as it is surgically called. It is an affection of the spinal cord, which is produced by reflex action proceeding from the nerve which has been lacerated, reacting upon the spinal nervous system. There is a stiffness about the jaws and neck, which is slight at first, but slowly increasing in intensity, and ultimately the muscles which move the jaws are no longer able to act; they become fixed and rigid, so that the jaws can neither be opened nor closed, and tetanus is established. It is generally fatal. There is a form of tetanus which arises from other causes, such as poisoning by strychnine, but this latter differs from traumatic tetanus, or that which is due to a wound. In the one case the invasion is sudden, in the other it comes on gradually, and, of course, after a punctured or contused wound has been known to have been received. In lockjaw connected with wounds the mischief is restricted at first to the stiffness in the jaws, but in poisoning by strychnine it almost immediately invades other muscles in the neck and back. It is requisite to keep this distinction in mind, and not let strychnine poisoning be mistaken for lockjaw. Lacerated wounds seldom bleed much unless an artery has been torn. They are sometimes followed by erysipelas; the course to be followed in such cases will be mentioned when treating of the latter disease.

Punctured wounds.

(5) *Punctured Wounds* are often more serious even than lacerated wounds, especially when made with a narrow pointed instrument, such as a rusty nail. The thrust of a penknife or one blade of a pair of scissors

may go a considerable depth, whilst the external wound may be quite small. In a stab the danger always depends upon the injury which the fibres have suffered from laceration as well as from the cutting surface of the instrument. The puncture may have passed through an artery or a vein without dividing it, and the surgeon's aid must be quickly obtained; in the meantime, it is prudent to keep the wounded part at rest as much as possible, and if any application is used let it be carbolized oil poured into the wounded part and the air kept from it, whilst if there is hæmorrhage, it may be restrained by gentle pressure upon the wounded part until the surgeon arrives. Suppuration will take place in these cases, and that as well as the constitutional disturbance is to be met as is suggested in the case of a lacerated wound, and we must guard against the violent inflammation which often supervenes.

Poisoned wounds.

(9) *Poisoned Wounds* are of several kinds, such as those produced by the stings of bees, wasps, and hornets, and the bites of vipers and other snakes; the absorption of poison from metallic applications, and those which follow upon the absorption of animal poisons, such as comes from the decomposing flesh of animals, and the so-called dissection wounds, which boys will get sometimes from their curiosity in investigating the nature of decomposing animal remains; and lastly, dog and cat bites, which are very uncomfortable, and frequently most painful.

Wasps.

The stings of bees, wasps, hornets, and other insects are best met by applying at once to the injured part some alkali or alkaline earth, which shall neutralize the acid of the sting. The old woman's application of the blue bag is founded upon good chemical action, for the chalk in the blue neutralizes the acid in the secretion from the sting at once, if it be applied immediately. A little sal-volatile in water, one part in three, may be useful if put on immediately, but it is not of any use to apply ammonia in any form, unless at or immediately after the moment at which the bite is inflicted. If any inflammation has come on, the application of sal-volatile or the ammonia salt will increase it, doing harm instead of good, and possibly setting up erysipelas or some other inflammatory action. Every wasp or bee destroys itself by leaving the sting in the flesh of the injured part. This must be extracted by means of a fine pair of tweezers or forceps. The resulting inflammation may be kept down by the application of a cold lotion, or dusting it over with violet powder or simple chalk, and avoiding irritating applications of all kinds, and also keeping it from the effects of the sun-light, if it be a hot day.

Snake bites.

Snake Bites in this country are limited to those of the adder. These bites are not usually fatal, unless the blood of the bitten person is in a very unhealthy state from excessive use of stimulants or too much animal food. There is generally faintness immediately after the bite has taken place. This faint condition should be counteracted by some sal-volatile or other diffusible stimulant, and the bitten part treated just as described for a wasp sting. The inflammation and swelling are sometimes very great, and there will be a strong desire on the part of the surgeon to use the knife, and to make free incisions to relieve the tension. I am satisfied from experience that this is wrong treatment, and that every effort should be made to prevent the chance of suppuration, which incision increases. There will be no formation of pus, except under the most exceptional circumstances, and there will be no ultimate danger if suppuration does not arise. Keep the swollen part warm, and avoid pressure. It will be found to subside in a day or two without leaving any mischief behind it. Nitrate of silver is sometimes applied to stay the resulting erythema. This is bad practice.

Pyæmia.

Wounds which have been poisoned by decomposing animal matter belong to a different category. These are followed by inflammation of the veins and absorbents of the part, and quickly extend to the whole of the system. Pyæmia results. In the case of an adder-bite the mischief is restricted to the cellular tissue of the limb affected, and the action of snake-bite is probably chemical. The resulting inflammation does not reproduce its like, but in the dissection wound there is a manufacture of material in the body of a similar kind. The morbid matter is reproduced in quantity, and is capable of reproducing similar mischief in other people. The pain follows the course of the veins and absorbents. There is much constitutional disturbance, and the assistance of the surgeon must be obtained as soon as possible.

Poisoned wounds to be sucked freely.

If there is a suspicion that a particular wound is a poisoned wound, the possibility of damage from it may be diminished by suction. No danger results to the person himself who applies this kind of treatment. When the wound is caused by the bite of a dog or other animal, or by the sting of a snake, the free application of saliva is useful; perhaps it is the most useful application which can be put into the wound. It is comparatively useless to cauterize such a wound in the way in which it is ordinarily effected. It is often done even the day after the wound has been inflicted, but it cannot overtake the consequences produced by the offending matter. The effects of such a wound are best met by using constitutional remedies, such as the surgeon may direct. The bite of a dog is comparatively of very little consequence if the animal is not mad: probably not one in a thousand of the bites which are made by dogs in everyday life are followed by evil consequences. Most of them are produced by the animals in play. A boy finds his hand in the dog's mouth, and, withdrawing it hastily and almost instinctively, he tears his flesh by contact with the sharp teeth of the animal. No evil will be likely to follow from this accident if the boy is in good health. If the wound is seen immediately, and if there is any doubt on the point as to rabies, a solution of caustic may be applied to it; or, better still, a little sulphurous acid may be put on after freely sucking the wound with the lips and moistening it with saliva. If the dog is really rabid, strong nitric acid should be applied at once to the wound, so as to destroy the whole of the bitten part; but this must be done by a surgeon, and, until the skilled practitioner arrives on the scene, suction, and then the application of some simple matter such as carbolized oil, will be all that should be attempted by an unskilled hand. Bites made by cats, horses, and other animals are occasionally very disagreeable, but to all these carbolized oil, or sulphurous acid (SO_2), is the best application after cleansing the bitten part with warm water, and sucking the wound. If the constitution of the child is healthy, there will be nothing but local irritation set up.

Dog-bites.

Hydrophobia.

The consequences of hydrophobia are, in reality, very frightful, and as a sequence to the fright produced by the bite of a dog the frequency with which mischief results is magnified. Cases are fanned into activity by the mental anxiety of the bitten person, Inquiries not to be addressed to the bitten person.

assisted by the anxious inquiries of the friends. It is very important, as regards its effect upon the bitten person, that no inquiries should be addressed to him as to the bite or his feelings regarding it. If he can forget it, so much the better,—his nervous system will not be made more sensitive or more ready to take on the nervous action, which assists to fan the disease into activity.

If a boy has been bitten by a dog which is supposed to be mad, no reference should ever be made to it by the masters; and, if possible, his schoolfellows should be cautioned against talking to him about it. If there be a minute dose only of the poison inserted in the flesh of the boy, it may be dwarfed, and it may abort instead of being fed by the morbid matter which nervous alarm itself produces, and which is the result of nerve disturbance in the boy's mind reflected upon his body. This is probably the pabulum upon which the poison feeds. It seems to be established pathologically that there is a very rapid extension of effect along the nerves from the parts injured to the spinal cord. This extension takes place during the incubative stage. The disease then affects the spinal and the sympathetic nervous system, and through them the emotional nerves, in a manner which, from the effects produced, is known by the name of hydrophobia. Let me repeat that not one in a thousand of those bitten by dogs run any risk of being a victim to this terrible complaint, and probably not one in ten who have been actually bitten by a mad dog do get the disease in question. A large number of those who suffer from it have a morbid dread of it, which has been sometimes produced by the mistaken anxiety of the companions and friends of the bitten persons. If it

How to apply NO_5 or SO_2.

is certain that the dog which has inflicted the wound is mad, it is right to pour some nitric or sulphurous acid freely into the wound, if it can be done at once, as the acid finds its way into the deepest part of the injured flesh. The application of lunar caustic is not so likely to be as effectual, because it may not get into the deepest part of the wound itself, and then the morbid matter is not entirely destroyed. Nitric acid is sometimes better known by the name of *aquafortis.* It is a powerful corrosive, and destroys every part of the skin or other tissue with which it comes into contact. It must be very judiciously used. To avoid injuring another part which ought not to be touched by the acid, we may apply a coating of sweet-oil. The oil will limit the immediate effect of the acid and prevent it from producing unnecessary injury. It would be highly imprudent to apply nitric acid in the neighbourhood of the eyes, if the wounds are upon the face, except under medical advice. It is, fortunately, very unusual for bites of rabid animals to occupy that position, the hands, arms, and calves of the legs being the parts most usually attacked, and to those nitric acid may be applied without much danger. The best way to use it is to make an extemporaneous brush by means of a wax lighter or wax lucifer match. Light the taper, let it burn a few seconds, blow out the flame, and fray out the wick into a brush form. Plunge the newly made brush into the acid and brush over the bitten flesh, letting the acid drop into the deepest part of the wound. The acid does not destroy the brush itself. If a medical man is at hand he will probably incise the wound so that the acid may certainly get to the bottom of it, but a knife used for such a purpose in the hands of the unskilled operator will probably be as dangerous to the victim as the bite itself. It is not therefore to be done except *secundum artem.* The parts so treated should be covered up with carbolized oil, and preserved from further injury by keeping it perfectly quiet. More mischief is done sometimes by using the damaged part too much after an injury, than that which results from the injury itself. The application of the acid leads to the destruction of the whole of the part which is in contact with it. This destroyed part has to be removed by a kind of exfoliation, and whilst it is undergoing the process of removal, the neighbouring tissue is actively at work to repair the damage which has resulted. The destroyed part must be kept from putreficative action. Carbolized oil will effect this object, and, with perfect cleanliness and quiet, will be all that will be necessary to allow the wound to heal rapidly, provided the child is in a healthy state. If he has not been excessive in the use of flesh as a food, if that flesh has been of a healthy and proper kind, and he has not been accustomed to stimulants, no evil will be likely to arise; but those children who are overfed, and who are allowed to take stimulants, run the risk of mischief from which their fellows are free. Abscesses form, or erysipelas is set up, or there is pyæmia, or so-called septicæmia results. The child is then said to be under the influence of blood-poisoning, and perhaps dies from its effects. This result arises from the *nimia cura amici*, and the loved one is killed by a mistaken kindness.

'Nimia cura amici' to be avoided.

It is necessary to draw a distinction between hydrophobia and rabies. Many more dogs have the latter disease than the former, and there is less danger of human infection from it. Rabid dogs are inclined to bite at everything that comes in their way, whilst hydrophobic dogs only bite those who interfere with them; the former animal is thirsty, wants water, but can't drink it, and foams at the mouth, and has fits, howls and barks. The latter dreads the sight of water, and is almost convulsed if made to touch it, but does not foam and does not have fits, and does not howl or bark, but some eminent authorities regard both kinds as the same disease.

Treatment of rabid dogs.

As regards the treatment of dogs suspected of madness, it is wrong to kill a suspected dog at once; compulsory confinement should not, however, be long continued, as if the signs do not develop themselves soon the dogs may be let alone, but all ownerless dogs should be destroyed. I think it most unwise to muzzle the poor animals, as if anything will develop the disease it is the miserable contrivances which are used for this purpose. It ought to be put a stop to by the Society for the Prevention of Cruelty to Animals.

Gun-shot wounds.

Gun-shot wounds are not often likely to require attention among schoolboys, but the effects are to be met in the manner proposed for contused and lacerated wounds. When small shots have penetrated some depth, it is unwise to poke about with probes to try and get them out. Cover up the part with carbolized oil, and let the shot alone; it will probably become encysted and give no trouble, provided the boy is in a healthy state, or it may find its way out in the course of time.

The same principles should guide in those injuries that result from the explosion of gun caps or gunpowder. It is best to avoid irritating the part by injudicious efforts to extract that which is not clearly seen: it will probably be expelled by natural processes if it be let alone.

Pieces of glass bottles and broken pottery may be easily felt, and should be extracted by the aid of forceps or tweezers. They ought not to be left in a wound, as their sharp edges are sure to irritate.

Wounds on the scalp require the hair to be cut away on either side of the wound for a short distance, and that it be picked cleanly out of the wound, otherwise it is likely to set up irritation.

Erysipelas.

It is seen that erysipelas may arise in a person prone to it without there being necessarily a seed, or germ, or potent factor, from an antecedent case; some always pre-existing germ having been hatched, so to speak, by abnormal and unusual conditions of the body, and then propagates itself, if circumstances favour it; particles from such a case may then be transferred from it to the tissues of another person. If these particles find damaged material in these tissues, such as are present when a cutaneous injury has been inflicted, and there is the usual reaction which follows injury, viz. an attempt to throw off the damaged tissue, erysipelas may be set up in that tissue, and it then spreads itself from that case to the inmates of the establishment, attacking any one who may happen to be wounded, even if it be only by a scratch. It is very necessary, therefore, when a case of erysipelas arises in a school, that the same rules be adopted for isolation and disinfection as are used against scarlatina or measles, and thus now and then a serious mischief may be altogether prevented. It is not usual for all medical men to look upon erysipelas in the same light that I do, but evidence on this point is too strong to be much longer overlooked. I therefore urge managers to take the safe course, and act in the only way which can prevent the extension of the disease.

Isolation and disinfection necessary.

CHAPTER III.

CUTANEOUS MALADIES.

Boils.

Boils.—It is not unusual to find several children in a given school to be suffering from a crop of boils, arising either at the same time or in rapid succession one after another. Boils are hard, prominent swellings, with a deep redness in the surrounding skin, exceedingly painful, terminating in an imperfect kind of suppuration. They commence in two or three different ways. In one kind, a slight itching begins in the skin, which, being scratched, the head of a small papule is taken off and a wound is made, from which a minute drop of serum, or blood, exudes; but very soon the base of the papule gets harder, extending its borders, both on the surface and into the tissue of the true skin, and spreads to the cellular tissue underneath. Several may appear at the same time. They may arise on the back and about the arms and the neck and legs; scarcely any part of the body is entirely free from their inroads. Another class commences in the cellular tissue beneath the skin. It may be some days before a blush of redness on the skin shows that it is about to break out and discharge. The third kind are deeper still, and form about the fundament and other loose parts, giving rise to abscesses of a considerable size. The figure of the ordinary boil is a small cone, the base of which is below the surface of the skin, and the apex is like the top of a volcano in miniature. This has a whitish speck, under which is a small depression. If the head is removed, a little dead cellular tissue is exposed, with a minute quantity of imperfect pus, or matter, and presently a little serous or bloody fluid is discharged. They are generally about the size of a sixpence in superficial area, but the surrounding redness may extend over a much larger surface, and the superficial hardness sometimes exceeds half-a-crown in diameter. They are exceedingly painful when they happen to be in the nape of the neck, or about the joints, as the wrist or armpit, or wherever the skin is liable to friction from the movements of the body or the limbs. In very young children they are often not nearly so painful. I have seen a school in which typhoid fever has attacked several of the inmates, and boils accompanied the cases, and after the typhoid had been removed some of those who did not suffer from typhoid suffered from a crop of boils, similar to those which appeared on the typhoid cases. They appear in the young as well as in the old, they attack the plethoric or the feeble, and no kind of constitution is certain to be free from their ravages. They are in a manner infectious, and capable of being transferred from one to another. It has happened to myself on several occasions to have small boils upon my own arms when I have had to treat several other persons, and I have reason to believe that I have caught the disease from my patient; so that in the end I learnt caution, and took care not to get any of the discharges from boils or from their exaggerations, 'carbuncles,' upon any part of my own skin.

They are infectious.

Sometimes they are very acute and rapid in their progress, at others they are indolent and slow. These latter have a more hardened base, and are much less painful than the acute variety. There is much difficulty in obtaining any kind of suppuration, and the hardness may remain for several weeks after they have ceased to discharge. Even in the acute form, after discharge has taken place, there is a hardness left behind, and whilst any part of this hardness remains in the cellular tissue, the patient is not free from the chance of a return of his complaint in some other place. The cause of boils is said to be some kind of cacozyme, which develops in the cellular tissue. It is of parasitic origin. It is very probable that they are connected in their origin with the introduction of some vitiated article of food, such as milk or butter, from a cow which has some defect in its constitution, or from some food which has not been cooked enough to destroy the parasitic germs which may possibly infect it, or they may have origin from bad hygienic surroundings.

Causes.

Treatment.

Those boils which arise on the surface of the body, and then get deeper in, may be arrested by the action of tincture of iodine. If a drop or two be inserted in the itching papule two or three times in the course of the day, the majority of them will abort, and not develop into typical boils. The fine point of a stick of lunar caustic is sometimes used, but I prefer the iodine. If it is not successful in preventing the development, it is better not to continue its application for more than a day or two, but to leave the boil to take its course, covering it up with a little resin ointment, or yellow basilicon, as it is commonly called. A small portion of the ointment should be put on the top of the volcano, then a little fluffy cotton wool and a pad of cotton, shaped like a bird's nest; put wool over it, and keep it in its place by a loose bandage, a handkerchief, or a slip or two of adhesive plaster; so that all pressure may be taken off the sore, and friction altogether prevented. This kind of treatment is much more satisfactory than poulticing. It will be noticed that a boil which has been poulticed for any time is followed by a crop of secondary boils around the first. The warmth and moisture which a poultice promotes places the surrounding skin in the most favourable position for the growth of the parasite, upon which I believe that the extension of the boil depends. Still, when the boil is close to one of the orifices of the body, and liable to be rubbed, it may be useful and very comforting to poultice for a few hours just before the time of discharge, if there is retained matter; but as soon as it commences to discharge, the poultice should be at once discontinued and the yellow basilicon applied. The ointment should be continued as long as there is the least appearance of discharge from the place. Some persons put a piece of plaster over the boil and leave it alone altogether. It is a successful practice sometimes, after treating a boil with tincture of iodine for a day or two; if the place shows signs of departure, it may 'speed the going guest,' and save it from friction and irritation; but to put a plaster on a boil which is really developing is not nearly so satisfactory in its results as keeping the top of the boil moistened with yellow basilicon. If the place is small, a portion of chamois-leather soap plaster may cover it, first putting on a small piece of wool having ointment upon it covering the boil. In that case the plaster should be cut crossways just over the boil, so as to prevent any pressure upon the top of the boil itself.

Don't poultice.

Apply yellow cerate.

When they form in the neighbourhood of the fundament, the victim should keep in bed, and occasionally foment the part with a sponge wrung out of hot water. Boils in that position may be dangerous, and lead to other troubles.

Surgeon only to lance a boil.

It used to be the custom to lance boils. It is a barbarous custom, and does not help the case forward a bit, except in those which are indolent and will not suppurate, and are in awkward situations, as in the armpit or between the thighs. It never does to produce a greater injury to cure a lesser one, and a great injury may be done by cutting into flesh which should not be interfered with. The surgeon may sometimes see the necessity for incision from the possibility of other mischief, such as may arise from pressure upon an important organ, or because there may be a tendency to extend in the deep tissues; but, except in such situations, it is far better to leave nature to perfect her own work, and to let the tissue in which the parasite has spread its venom be thrown off out of the body by natural means. Neither do I think it of any use to give medicine to those who suffer from boils, unless some function is improperly performed, or some evident defect of power is present. If there is foul tongue, loss of appetite, confined bowels, and other constitutional disorders, each symptom should be treated according to the rule which will be laid down hereafter for each departure from natural states. It is really useless to give the medicines which are sometimes highly recommended, such as yeast, porter, and wine. Such things don't really help the case. The general condition of the patient should be dealt with according as to whether 'he is well nourished or enfeebled and anæmic.' Quinine and iron, in some form or other, will be beneficial if the face is pale and the patient weak, and mineral acids may be useful, but they should be only prescribed under medical direction, and stimulants as a rule are worse than useless.

Carbuncle: Its treatment.

Carbuncle.—It is not unusual for a so-called carbuncle to develop out of an ordinary boil. The hardness at the base of the boil does not resolve itself in the usual manner, but vitality ceases in a large part of it, and it is thrown off as a slough, several holes appearing upon the surface. The carbuncle may appear as a small speck at first, but it sometimes rapidly develops itself, especially in the nape of the neck, and often sets up serious mischief. If the place is only an inch or so in diameter, it may be treated precisely in a manner similar to that prescribed for boils, viz. with yellow basilicon and cotton wool. If there is much slough, it is a good plan to sprinkle upon it at each dressing a few grains of animal charcoal. This application destroys the foul odour which sometimes arises, and clears the wound imperceptibly of the slough and its disagreeables. It must be done carefully, otherwise it creates a black-looking patch, and tends to frighten the patient into a belief that there is general mortification. Carbuncles, as well as boils, easily bleed if they are rubbed, or if the slough is dragged away by violence. The core or slough should be allowed to separate without using any force, and if the hole which forms in consequence of the destruction of skin is filled with soft cotton, first applying on the place a little softened basilicon, it will be the best kind of treatment that can be used. When the place is excessively painful, it may be fomented occasionally with some hot water in which a few poppy heads have been boiled. Some prefer a poultice made with boiled carrots. It is useful when there is much slough, and may be applied for two or three hours a day with advantage, especially in those cases in which charcoal powder has been used.

Chilblains and chaps.

Chilblains and Chaps.—Closely allied to boils in appearance, but not in cause, are the swellings which are produced by frost and cold. Chapped hands arise, in a great measure, from neglect in not sufficiently drying them after they have been washed. If they are exposed to the cold air in a damp state, the effect of evaporation is to chill the cuticle. When there is a low state of vitality in the system the consequence is soon manifest. The cuticle is destroyed, and is thrown off before its natural exfoliation is completed. The result is a rapid rise of a so-called inflammatory action. Heat, redness, a swelling with some amount of tenderness, supervene in the swollen part. Some children are much more susceptible to a chapped state of skin than others, from constitutional weakness. When the chilled condition has extended to the *cutis vera*, or true skin, a chilblain is produced. These effects are very prone to form in those who have a weak circulation; who are the children of persons who have been addicted to high living; who have trusted to meat and stimulants as the staple articles of food, rather than to more simple diet, and who have not had a proper supply of milk and vegetables. The fingers and toes, the tips of the ears and nose, sometimes parts of the skin on the arms and legs, are affected. In the case of chaps, the mischief is limited to the cuticle. Every one who does not dry the skin thoroughly is liable in cold weather to have this condition produced. The greatest care should be taken to remove all moisture from the skin, especially in cold and frosty weather. It is beneficial to smear the hands with a minute quantity of honey, after washing, and before drying, when the weather is really cold. The application of honey makes the drying a more tedious process, but it is capable of being more thoroughly performed than when honey is not used. If the chaps have been actually produced, and the skin is cracked, it requires the application of something more stimulating than honey. I generally use an ointment such as the following:—One part of camphor, six parts of spermaceti ointment, and one part of citron or golden ointment. These should be thoroughly well mixed, and the cracks smeared with the mixture at bedtime, after the hands have been well washed and properly dried. Two or three applications will be sufficient to effect a cure. The parts smeared with the ointment should be covered up by Berlin or silk gloves. The lips are sometimes chapped; they should be painted with a little solution of the tannate of glycerine, and the application allowed to remain upon it for a few minutes before it is wiped off. The cracks should then be touched by a little strong camphorated oil—four parts of salad oil, and one of camphor, being rubbed together so as to make an application; the thinnest possible coating should be applied by the aid of a camel's-hair brush; or a camphor ball, such as all druggists supply, may be used. If the chill has extended to the cellular tissue, there is active inflammation. The vitality of some of the minute capillaries has been interfered with, and the blood has stagnated in them. As a consequence, there is obstructed circulation, and a local dropsy results. Children who have been accustomed in cold weather to wash in hot water, are more liable to chilblains than others, especially if they have been improperly fed. Any sudden change of temperature ranging

Treatment.

Promoted by use of hot water in cold weather.

below 40° may produce chilblains, though they are much more decided when the temperature is absolutely below the freezing-point. Those adults who are accustomed to wash their hands in hot water in frosty weather are very liable to them. Children whose feet are kept too hot, or who are badly shod, and who get their feet damp in severe weather, suffer much from the effects. There is impeded circulation, then an intolerable itching, and scratching only adds to the pain and the inflammation. If the malady be properly treated, it remains a simple chilblain, and is soon removed; but if the process of exposure be continued, if it be scratched excessively, the skin breaks, and the cellular tissue beneath is exposed, and then a painful sore results. The best kind of treatment is a gentle friction with the warm hand. If the skin is not broken, the part affected may be covered up, and supported by chamois leather spread with lead plaster; but if the skin be broken, a stimulating ointment may be applied. The best kind is, one part of turpentine rubbed up with seven parts of yellow basilicon, and applied on lint twice or three times a day, taking care to keep the affected part perfectly dry. Persons who are very sensitive to cold, and upon whom chilblains easily appear, should take a dessert-spoonful of cod-liver oil every night on going to bed, when the thermometer shows a temperature constantly below freezing-point. Stimulants, such as wine and beer, will not assist to remove the cause which allows of the production of chilblains, although they are remedies which are much vaunted by some authorities.

Prevention.

Frost-bite.

I can scarcely pass over the subject of frost-bite, though it rarely happens in this country, but now and then a child does inadvertently get frost-bitten in very severe weather. A condition, which corresponds to that producing chilblains, extends in the tissues beneath the skin until the vitality of the organ may be entirely destroyed. There is numbness at first; an attempt is made to restore the circulation, there is intense pain; the mischief is done before the latter arises at all; when children's fingers are frost-bitten, as will happen sometimes when they are intent upon snow-hut building, or even snow-balling, it is very imprudent to warm them by exposure to a fire, or by plunging them into hot water; the chilled part should be only rubbed with a warm hand, using at first a litttle snow-water, and then simply the heat of the hand itself, and very gently too, until the deadly pallor in the part which announces the arrest of circulation, gives way to a more florid aspect. This must be done carefully and slowly, otherwise mortification will be the natural result. Powerful stimulants are to be utterly avoided; they are certain to produce mischief. Some other directions will be given upon this head when treating of the rescue of drowning persons.

CHAPTER IV.

DISEASES OF THE SKIN.

THE transition from boils and chaps and chilblains to diseases of the skin appears to be a most natural one, but it is not strictly scientific. As, however, we are treating this subject from a popular point of view, we may consider this troublesome and disagreeable set of cases at this part of our subject. The skin is often much damaged by the continuous poulticing to which boils and blains are but too often subjected, and some of the most obstinate skin affections date their commencement from some application which has been used for some other object. I have already treated of the class of maladies which are styled eruptive fevers, or 'the exanthemata,' as they are termed by medical men (see p. 167). They are attended by high fever, and are all infectious or contagious. They include measles, scarlet fever, small-pox, *et hoc genus omne.* Another class of infectious complaints, which are truly parasitic, affecting the hair and skin, have also been already dealt with. It remains now only to take account of those diseases of the skin which are called tetters, breakings-out, scorbutic affections, etc. They are chronic in their course, and are not usually attended by feverish disturbances. Some of them are very difficult to cure, and leave

Chronic diseases of the skin.

lasting impressions behind them. There are several distinct classes, such as papules or pimply diseases; squamous or scaly affections; others are vesicular or pustular. These divisions are not natural,—a papule may become a pustule, and a vesicular disease, such as eczema, may lapse into a scaly kind. Others are simply blisters; whilst the disease called itch may take on almost every kind of form, viz. pustular, papular, or vesicular. There is no truly natural classification for skin diseases, but for convenience of description I will take them in the following order:—

1. Papules. 2. Scales. 3. Vesicles. 4. Pustules.

Papules.—These are small elevations of the cuticle with hardish bases; they do not suppurate or form pus; after a time (sometimes extended) the hardened base declines, a small scale forms, which is not exactly a scab; it rubs off, generally in consequence of some scratching, or, when it appears on the face, by the act of rubbing; it may recur in the same place. There are several kinds of papule. Their names are: (1) Acne, (2) Strophus, (3) Lichen, (4) Prurigo.

Acne, or spotted face.

Acne.—This affection is common upon the faces and necks of young people; it is caused by an inflammation of the sudiparous or oil glands, and the tissues immediately adjacent. The sebaceous matter is concreted into a solid form; it distends the excretory duct and even the hair follicle. It then comes into contact with the dirt contained in the air, and forms a black spot on the skin. These are sometimes squeezed out, and a thin maggot-like body exudes. Children are wont to describe the victims of this disease under various fanciful names. It is more frequently seen in young men and women just as they approach the age of puberty, than in younger children, and usually disappears in the course of a few years

It is more usually met with in those parts of the body which are exposed to the influence of the atmosphere. There are several varieties, such as the simple, the indurated, the punctuated, and the form called acne rosacea, in which the integument around assumes a livid hue. This last is not often seen in young people; it is more usual in those who, having transgressed the rules of propriety, have their errors discovered later on in life; and whilst the simple forms are easily removed, acne rosacea is most intractable.

Treatment.

Treatment.—The simple form may usually be got rid of by a proper application of soap and water, with gentle or vigorous friction, according to the condition of the base of the papule. Friction with sulphur ointment is useful at times, and in obstinate cases a lotion containing one grain of bichloride of mercury in an ounce of emulsion of bitter almonds will generally remove the complaint. The lotion should be applied at bedtime, a little being rubbed into the orifices of the glands which are faulty. The general health requires attention; fresh air, exercise, attention to diet, and some saline laxative may all be indicated, according to the habits of the person affected.

Strophus, or Red Gum, or tooth-rash, is a malady affecting infants, and need only be mentioned here; it is closely allied to lichen; it requires attention to cleanliness, and the removal of causes of intestinal irritation which are common among infants.

Lichen.

Lichen is an eruption of minute papules, reddish in colour, conical in shape; they produce an intolerable itching, and terminate in a branny kind of scale, which causes a shower of *débris* when the undergarments are changed. There are several varieties, which have distinct names, derived from the shape of the patches, position of the papules, or colour of the neighbouring skin. Lichen tropicus is the prickly heat of the tropics. They all appear usually without any constitutional disorder. They are not common among children, and, as well as its companion prurigo, will require the aid of the doctor for its cure.

Scaly diseases.

The *Squamous*, or *Scaly Diseases.*—This class is made up of two or three very distinctive forms, which in their typical state are easily recognisable. They are not inconsistent with apparent good health. Children are frequently sent to school suffering under one of the forms belonging to this class, viz. psoriasis; it is perfectly free from danger of infection. It affords a curious comment upon names, for we find that originally it was applied to the Eastern disease 'leprosy,' and was synonymous with the term venomous, or malignant. It is now appropriated to a condition of skin which is only an increased secretion of scales. This arises from an inflammatory state of cutis; there is exudation into, and thickening of, that structure. These actions are local, and are not attended with any evident constitutional disturbance. The surface of the skin is dry, there are neither vesicles, pustules, or any ulceration. The affection may exist in the form of simple spots, when it is called 'psoriasis punctata,' each restricted to a single hair follicle. Sometimes these spots slowly increase in size, and each occupies an area the sixth to the third of an inch in diameter, when it is styled 'psoriasis guttata.' These patches are sometimes almost white, and are frequently called lepra; or the disease may occupy larger patches of skin from the first, it is then called 'psoriasis circumscripta,' or 'diffusa.' Patches may become inflamed, and give rise to an exzematous rash, and it is even difficult for the expert to determine at first sight whether the disease belongs to the scaly or the vesic-

Lepra.

ular class. As it subsides the scales fall off, and leave roundish red spots, which may be dull or copper coloured; at length they die away, and the skin is left without any mark or discoloration to show the former position of the eruption. This may be somewhat changed by the excessive scratching to which the spots may be subjected by the patient.

Sometimes the disease affects the nails, they become brittle and split, or it is limited to the palms of the hands and soles of the feet. These cases are probably connected with an hereditary blood depreciation, consequent upon syphilis in a former generation. Sometimes the disease is excessively obstinate, the skin cracks, and serous discharges ooze from it. It is then called 'psoriasis inveterata.'

Psoriasis.

If children can be kept clean, there is nothing in these cases to prevent them from mixing with their fellows. It is a chronic disease, especially liable to relapse. It would be wrong to exclude the subjects of it from going to school on account of its nature. Probably half the cases which actually arise do occur in children. It is not uncommon, and it is well that managers should be able to recognise it, and act accordingly. Occupation and regular habits, by promoting good health, may help to cure it; whilst foul air, bad habits, and improper food will tend to make it 'inveterate;' excess in eating and drinking, fatigue or excitement of any unnatural kind, will render it more intractable. It requires medical treatment for its cure, which will be generally found in the internal administration of minute doses of arsenic or iodide of iron, and the local application of some of the creosote or tar preparations which are now frequently to be met with. The diet should be simple: salt meats, pork, spices, and stimulants should be altogether prohibited.

Coffee, by drying the skin, is also injurious. Fresh fruits, vegetables, and milk foods are more advantageous than meat. If there is a syphilitic taint, it will continue to tease the constitution until some other and more serious malady takes its place.

Pityriasis, or bran-skin.

Pityriasis is another scaly disease. The name is derived from a Greek word signifying bran, and a branny kind of scale is its distinctive feature. It is requisite to avoid mistake, and not to confound it with the desquamation which arises after measles or scarlatina. It would be difficult for the non-medical mind to distinguish the one from the other, if it were not for the general illness which had preceded the one, but not the other. It is sometimes mistaken, and much unnecessary alarm excited when the skin disease is thought to be the sign of the eruptive complaint. Another mistake is often made regarding the form which is known as 'dandriff,' 'pityriasis capitis.' This is due to an excessive secretion from the sebaceous glands in the scalp, and may be mistaken for infectious disease, whilst it is really harmless; but it is indicative of a want of cleanliness, and the collection of scales in the hair may be a nidus for infectious disease, if such children come in contact with the germ which produces ringworm or favus. A form of chronic erythema is sometimes improperly called pityriasis; it is seen at the corners of the mouth, on the lips and cheeks of delicate children. It may be induced by the use of soaps which are too alkaline, or by any means which will take off the epidermis in too rapid a manner, by which the tender cuticle is too much exposed. 'Pityriasis simplex' occurs in the form of small white round patches in the hairy parts of the body, which become covered with branny scales, and may give rise to patches of baldness. The baldness will not arise if the patch

Dandriff.

Simple pityriasis.

is cured quickly. This may be rapidly effected by using a solution of borax in rose-water (one dram of the salt to the ounce), and afterwards applying a solution of bichloride of mercury, such as was prescribed for the cure of acne.

Frequent bathing in soft water, and an unction with pure salad oil, will help to get rid of the tendency.

There is a form of disease called 'pityriasis versicolor,' which is due to a parasite, and which can only be cured by destroying the fungus which produces it.

Fish-skin disease.

Ichthyosis, or the *Fish-skin disease*, need only be mentioned. It is sometimes seen in a very slight form, in which the skin is mapped out in a quadrangular or irregular-shaped segment, covered with slabs of cuticle, adherent in the centre, but loose at the sides. Sometimes the whole body seems covered with laminæ of cuticle loosely adherent to the cutis; it is smooth and shining. It is not of such a character as need excite the attention of the master, except to see to the scrupulous cleanliness of the child, and that the diet be always wholesome.

Vesicles.

The *Vesicles* consist of several forms of malady under the names: (1) Sudamina, (2) Miliaria, (3) Eczema, (4) Herpes, or Tetter, and a class which go by the name of (5) Blebs, or Pemphigus and Rupia.

Varicella and vaccina are sometimes called vesicular, but it is more convenient to class them with the exanthemata.

'Sudamina' are simple transparent vesicles, which are often met with upon the bodies of rickety or tubercular children, who sweat much. They are hemispherical and smooth. They are not uncommon in the course of continued and other fevers. 'Miliaria' are similar; they are not hemispherical, but acuminated and surrounded by a zone of redness. They are met with in cases of fever, and only call for mention.

Eczema. *Eczema* is one of the commonest of skin diseases. It arises in the form of minute vesicles containing serum. The fluid evaporates or absorbs, and their flakes or crusts are left. There is an erythematous condition, with heat and tingling. The skin is red and raw looking. As soon as the flakes are removed, or even before the removal, there is a fresh crop of vesicles. The parts burn or tingle and itch most abominably. It is closely allied to the papular and scaly forms of disease, and, when inveterate, renders life a positive burden to the sufferer. It may be set up by the use of irritant applications in constitutions prone to it. It often accompanies scabies, that is, the disease which the itch insect produces. I have often seen it rendered extremely difficult to cure by the action of the little microscopic red insect called the harvest bug, which frequents the thickets and hedgerows on the chalk hills of Surrey. It burrows into the legs and arms of boys who hunt them for birds' eggs and blackberries, and if the cause is not recognised, cure will not follow upon the treatment adopted. The distinctive characteristic of eczema is the fibrinous exudation, which stiffens and stains the linen garments of the wearer. The discharge, which comes from a simple chafe caused by friction ('erythema intertrigo' is its scientific name), is not abundant, and does not stiffen the linen, so need not be mistaken for that disease. **Eczema of scalp.** Eczema is common in children, and when it affects the head is called 'eczema capitis.' The discharge is yellow, from mixture with sebaceous secretion. There is excessive production of epidermis; the fluid becomes purulent, and the hair mats together, forming a disgusting mass. **Differs from ringworm.** This form differs from the infectious form called 'tinea tonsurans,' or favus, inasmuch as that the hairs are intact, not broken off, twisted, and sheathed with a fine white deposit, as is the case in favus. There is also no moist discharge. The disease sometimes affects the ears, especially the groove behind the pinna. It sometimes affects the hands in those who handle sugar, soda, dyes, and other irritating merchandise. 'Grocer's itch,' 'washerwoman's itch,' and 'baker's itch' are all varieties of eczema.

The treatment of this form of complaint is mixed up with constitutional remedies, and cannot be got rid of by local measures. Diet should be moderate, stimulants altogether avoided, and the immediate exciting cause be removed. The tendencies of the child must be considered as to whether there is any syphilitic, rheumatic, gouty, or scrofulous tendency, or whether it has had its origin in outside causes. The local crust should be removed by bread-and-water poultices, the hair must be cut to expedite the removal of the crusts, and the part affected kept scrupulously clean. A more decided course of treatment must be prescribed by the medical attendant, which will be according to the tendencies above referred to, for each requires a different class of medicine.

Herpes, or tetter.

Herpes, or *Tetter*, as it is commonly called, is a non-contagious and vesicular disease taking on several forms. The most common is 'herpes labialis,' a breaking out in the lips, which indicates cold, and may disappear after a few days; or it may be the accompaniment of a much more serious complaint, and is often one of the signs of inflammation of the lungs. It begins by redness and heat in a small patch. The vesicles scab over in two or three days, and if left alone fall off without leaving any permanent scar.

When they form in the throat they give rise to considerable constitutional disturbance.

Shingles.

'*Herpes Zoster*,' or shingles, is another form of the disease. This form is limited to one side of the body. It is occasionally preceded by very great pain, and has been mistaken for pleurisy, as its usual seat is on the ribs, although it may appear on any part of the body. The crop of vesicles is connected with some nerve disturbance, the nature of which is not yet fully understood. It commences with a hard inflamed base; the vesicle contains clear fluid at first. This changes in a few days to opaque lymph, which dries up and leaves a black scab. It is attended with a burning, pricking heat, and itches a great deal as it dies away. Old people often have a deal of neuralgic pain in the seat of the eruption, which may continue after all sign of the eruption has ceased, but this is quite unusual in children. Local treatment is quite useless. The vesicles should be covered up with cotton wadding, so as to avoid friction, and not interfered with; whilst if the appetite is indifferent, and the tongue foul, a little senna tea, followed by a dose or two of Gregory's powder, will be all the treatment that will be required. If the scabs are inclined to cause any breach of surface, they may be dressed with zinc ointment night and morning until they are entirely separated, and the surface of the skin has healed. 'Herpes cicinatus,' or iris, is a form improperly named herpes, and in which the disease is caused by a parasite. It is infectious.

Blobs.

The *Bullæ*, or *Blebs*, are serious forms of disease, which are not likely to be met with in children at school. They are connected with a blood disease, and always require skilful medical treatment to effect a cure. In *pemphigus* there are large blebs filled with an albuminous alkaline fluid, with an ulcerated under surface. In *rupia* the bleb dries up and forms a crust, which becomes thicker as it rises above the level of the skin, and when it drops off leaves a deep ulcer in the skin, which heals after a time, leaving a distinct and specific mark behind it.

The *Pustules.*—The last class to be considered are the pustules, excluding farcy and small-pox. They are limited to two forms, *ecthyma* and *impetigo.* They are not common diseases. The former are round isolated pustules, with hard inflamed bases, which form brown adherent scabs, and when they drop off they leave a violet stain in the skin, but this fades away in time. Tartar emetic ointment is sometimes used to bring out an eruption of this kind, for purposes of counter-irritation. The disease may be either acute or chronic. The latter assimilates very much to a crop of boils, but runs a slower course, is more painful, and has a core which does not form in a case of ecthyma.

Impetigo.

'*Impetigo*' is more common; it may be caused by local irritation, such as pediculi or lice in the heads of children, or by improper food or a poor kind of diet. The pustules occur in groups, which come to maturity in forty-eight hours, and rapidly discharge a thick purulent matter, giving rise to a brownish-yellow irregular-shaped crust. These crusts are slow in separating, and are sometimes mistaken for a more infectious form. The character of the pustule in impetigo capitis should at once distinguish it from tinea or favus. When it attacks the face of children it is called 'crusta lactea.' Impetigo is sometimes contagious, and seems to spread from child to child, so that care is required to distinguish it. It seems as if the secretion in the heads of some children render them excessively prone to grow crops of pediculi. The ova of these parasites, popularly known as 'nits,' will be seen attached to the hair. They may be detached by washing the hair with vinegar and water, and then dressing the roots with white precipitate ointment or decoction of stavesacre. This latter is the basis of the Persian insect powder, which is used for the same purpose. The presence of nits either favours the production of impetigo, or the latter encourages the breed of the former, as they are very often in company. Cleanliness and the use of sulphur ointment occasionally, if the presence of the nit is suspected, will be the best plan to adopt.

Pediculi or lice.

From preceding observations it will be understood that diseases of the skin arise from several causes: they may be constitutional and inherited, or they may arise from infection or local irritation. Each cause requires a different kind of treatment, but all require the most scrupulous cleanliness and attention to diet. It is requisite to distinguish the constitutional tendency, because it is of more consequence than the name of the skin disease. First determine the point as to its contagious or non-contagious character, then the constitutional tendency, and thirdly, attend to the diet of the child. This should be vegetable, fruits, fish, and milk foods, whilst stimulants, meats, and indigestible things should be studiously avoided.

General directions.

It is right that masters of elementary schools should be able to distinguish the different forms, so as to be able at once to determine whether a child should be placed in quarantine or sent home at once.

It will be right, before dismissing the subject of skin disease, to lay down some general rules of diet and some directions which may be observed in most cases of the kind.

Diet for children with skin diseases.

Breakfast should consist of bread and milk, or rice-milk, eggs, fresh fish, and bread and butter. Tea and coffee are best avoided.

Dinner should be plain roast or boiled fresh meat, fish, poultry, milk and egg puddings. Farinaceous puddings, boiled rice, potatoes and fresh vegetables, as fresh beans, cauliflower, etc., well cooked.

The evening meal should be milk or gruel, or other farinaceous food, bread and butter, poached eggs, toasted bread, perhaps a little cream cheese. It is better to avoid other kinds of cheese. Barley-water, thin water gruel, beef tea, and any of the mineral waters which are usually drunk should be the only beverages. Whilst salt meats, pepper, pastries, raw vegetables, spirits, and malt liquors are not to be touched.

Clothing.

It will be right also to give a few directions as to clothing. The first condition to be observed is, that cleanliness of person shall be rigidly observed, and although flannel is sometimes necessary to be worn, it is not always judicious when there is the least discharge of moisture or exfoliation. It is best to wear soft linen next to the skin. It is not a good plan, however, to wash over diseased skin more often than is absolutely necessary, but other parts should be washed frequently, using as little soap as possible: whilst it should never be used at all on the diseased surface, except under medical advice. The scalp may be cleansed with yolk of egg and warm water, and other parts of the body when diseased are more satisfactorily treated with thin gruel, or oatmeal and water, or water in which bran has been boiled, or even warm milk and water may be used. In drying diseased skin it is very necessary to avoid friction. Use soft linen for the purpose, and dab it, rather than

Cleansing.

use any kind of scrubbing process. By this kind of treatment we may avoid injury to the new skin, so as not to displace the altered parts until a new formation has taken place. Ointments and greasy lotions may be removed by these kinds of application better than by any other means, although poultices are sometimes necessary

CHAPTER V.

ABSCESS AND ITS ALLIES.

Abscess.—It is not uncommon to find a child suffering from the effects of an abscess, or gathering (as it is often called), in different parts of the body; an inflamed part is said to suppurate or gather when it softens in the centre and matter or pus collects in it. It is one of the results of inflammation, and may take place anywhere. In some parts they are comparatively unimportant; in others they are highly dangerous, and must not be neglected.

Formation of matter.

Matter forms in the first instance in consequence of some defective vitality in the part affected. The symptoms which indicate the formation of matter divide themselves into two classes: (1) those which are acute or rapid in their development, and (2) those which are chronic or of slow growth. In the first class of cases, there are the usual symptoms of inflammation, heat, swelling, pain, and as the matter approaches the surface, redness. When suppuration has really commenced, the pain gradually loses its acute form, and becomes more dull and throbbing; the hardness, which was considerable at first, decreases; the swelling becomes softer, and an elevation takes place in the

Pointing.

skin, which indicates that the matter is pointing to the place at which the abscess intends to open; the point assumes a conical form, the skin reddens and becomes thinner, and at length the abscess discharges a quantity of pus or matter, and the swelling subsides at once. If the suppuration is considerable, or if the part suppurating is a very sensitive one, there is more or less constitutional disturbance. The fact of suppuration is often preceded by a shiver or rigor, and some feverishness, which is indicated by quick pulse, hot skin, and furred tongue, with loss of appetite and general *malaise*, which will be more or less according to the character of the abscess. The discharge of the matter from the abscess will be followed at once by the diminution of the constitutional symptoms.

Chronic abscess.

In *chronic abscess* the constitutional symptoms set up are often very slight; sometimes a very large abscess forms without producing any apparent change, and one is surprised at the quantity of matter which may escape, either by accident or design, from a given swelling. It is necessary to determine the nature of a given collection of matter before deciding as to treatment. If it is the sequence of an accident, and the result of neglect, very simple means are requisite for its cure, unless the constitution of the child is bad, and the surroundings at home in an insanitary condition; in that case, very slight injuries and small abscesses may lead to very serious results.

Treatment.

It is a very common idea to suppose that it is best to open a gathering and let out the matter as soon as possible. This is an error. There are occasions when it is right and justifiable; but, as a rule, nature will do the work better than the surgeon, and the discharge will take place at the proper time and in a proper manner. The discharge may be assisted by poultices, but their use is as often mischievous as beneficial. They should only be used when the skin is sensitive, when there is increase of swelling, and redness commencing, and some tension of the neighbouring parts. As soon as the discharge has been free, and the inflammatory tenderness has subsided, the poultice should be left off, and some antiseptic dressing applied and treatment pursued as directed in the case of boil or carbuncle.

Injuries leading to abscess.

Small abscesses are frequently unnoticed, but they are very often the source of blood-poisoning, and give rise in the end to very serious illnesses, and even fatal consequences, by the septicœmic or general blood disorders which follow from the changes which are induced in the blood by septic germs finding admission into the system. Small scratches upon the body, slight punctures, or forgotten injuries, are often the means by which mischief results a few weeks or months afterwards. It is right, therefore, for the school manager to note these abrasions, and compel the children under his charge to attend to them, to keep them clean, and to prevent as much as possible contact with the outer air until the abraded skin has completely healed. Some popular remedies, as the inner skin of an egg-shell, goldbeaters'-skin, lily leaves, and other simple applications, are beneficial whenever they effectually keep out the external air from an abraded surface.

Whitlow.

Whitlow.—One of the most common sources of mischief is a whitlow; this is an inflammation at the edge or root of a finger or toe nail. It is often set up by a so-called hang-nail, a small piece of skin which has been detached from the edge of the nail by violence, and which is allowed to be irritated by dirt or continued rubbing; it soon becomes very painful, and, unless treated properly, is liable to end in abscess. All the symptoms of an acute abscess arise, and the child is not in a condition to do his school work. It is the usual custom to poultice these swellings, and to promote the formation of matter by increasing the inflammation in the part. This is wrong treatment. The best plan is to keep a little cold water upon the finger,—to apply a piece of wet lint around it. Keep it cool by frequently dipping it in a glass of water, and not covering it up with oil silk as is frequently done, but let the water constantly evaporate, so as to keep down the inflammation. In a few hours, or, at the most, a day or two, a small white spot will be observed by the side of the nail containing pus, which may be evacuated by means of a needle passed through the white part. The pus will escape into the lint. The cold water should be continually renewed until all tenderness is gone, and the part kept studiously clean. As soon as tenderness has departed, let it be kept covered up with a finger-stall, having previously applied a small quantity of Turner's cerate (calamine ointment) upon the edges of the nail to keep it moist, and so allow any discharge to escape. If the pus is deep in the tissues, or pressing on the bone, it must be let out by the lancet, but it will seldom happen that cold water, if applied soon enough, will not be able to prevent the development of this mischief; of course it will be requisite to avoid all games such as cricket, or fives, or marbles, or anything else by which a bruise may result to the finger. It is important to observe that it is only the inflamed part which is to be kept cool. The cold water is not to be applied to the whole of the finger, for if this is done vitality is reduced too much, and mischief may result. The hand is not to be chilled altogether. The same treatment must be used when the toe is the seat of the disease. It generally arises

Treatment.

in the great toe-nail, and in those cases has followed in consequence of an injury to the nail in kicking at football or other games, and the wearing a boot or shoe which is too small for the toe. It is curious to note the general neglect which is shown by parents and bootmakers to the natural position of the toe, and the necessity for allowing for its natural growth. There is no room left for this. The growing boy has a new boot made which is just long enough to contain his foot, but there is no allowance for that half-inch which will probably be added to the foot in the course of the next four months, and, as a consequence, the toe-nail is pressed into its tender quick, or the toe itself is bent out of its proper position, and the foundation laid for a bunion in future years.

Frequently caused by ill-fitting boots and shoes.

A new boot for a growing boy or girl should always be at least from half an inch to one inch longer than the foot of the wearer.

Avoid pressure.

It is very important to avoid pressure of every kind upon those small abrasions or gatherings which will sometimes arise from injury to the feet; water applications, provided they are frequently changed, will be better than poultices, though these latter are sometimes necessary when there is much tenderness and great heat; but small abrasions are best covered up with chamois leather, spread with soap plaster, and by that means fresh injury prevented.

Styes.

Styes.—These are small abscesses which form at the edge of the eyelids; they proceed slowly to suppuration, and are often very painful. When the pain is great a cold bread-and-water poultice for twelve or twenty-four hours is the best thing to be done, and after discharge has taken place, to touch the discharging part with a minute portion of yellow basilicon ointment, taking care that none of the ointment gets on the mucous membrane of the eyeball; it would do no real harm if it did, but would cause a little unnecessary smarting. Styes are an indication of a low vitality, and show that the blood is out of order. The eye should not be used by reading or writing when it is inflamed from the close proximity of a sty. If the lashes are matted together with small scaly bits of cuticle, it is advisable to touch their roots every night with a little citrine or golden ointment, and bathe them well in the morning with cold rain-water, and the scales should be removed from the eye-lashes.

The digestion should be attended to, some alkaline aperient given, and care used in regard to diet.

Quinsy.

Quinsy is another form of abscess, which has its origin in the tonsils; it generally arises from taking cold when the blood is out of order, and a perspiration, which was carrying out of the body some morbid matter, has been checked, and the discharging material thrown back into the circulation. Sometimes a herpetic eruption forms on the lips; in other cases, instead of appearing on the lips, it affects the tonsils. The tonsil looks at first rather paler. It does not show very decided redness until the enlargement is manifest, and the difficulty of swallowing considerable. In diphtheria the swallowing is not at first much interfered with. Acute pain on swallowing is much more likely to be quinsy than anything else. Sometimes we see an aphthous state of throat, consequent upon some blisters on the tonsils, which seem to be the analogue of herpes on the lips. The blisters form on the surface of the organ, instead of leading to suppuration inside. These conditions are closely connected with digestive disturbance. There is generally a foul tongue, severe headache, loss of

Treatment.

appetite, and confined bowels. A good dose of calomel and James' powder, in the proportion of two grains of each, is the best treatment, with a saline purgation on the following morning. If quinsy is forming, it is best to use a warm fomentation to the throat, to inhale steam frequently, and to encourage the discharge of matter as quickly as possible; but as soon as discharge has taken place, to gargle with cold water. Caustics and actively astringent applications are generally injurious, though frequently practised. They tend to weaken the throat, and render the patient liable to similar attacks.

CHAPTER VI.

DISEASES AFFECTING THE MOUTH AND THROAT.

The mouth and throat.

THERE are some affections of the mouth which are sometimes very troublesome, and cause much discomfort to children, and in consequence to teachers, such as *aphthous ulcers, or thrush*, *cankers*, *gumboils*, *teething*, *toothache*, *relaxed throat*, producing hoarseness, *aphonia* or loss of voice, *cough*, *hooping-cough*, *croup*. These form a convenient section of complaints which may be considered together, and naturally follow quinsy.

Cankers.

Cankers, so called, are owing to want of cleanliness, the presence of carious teeth, to disordered stomach in consequence of eating improper food, or continuing to feed either on that which is unwholesome or on a diet which is too exclusively animal. I have thought that the use of milk or meat which is the product of animals suffering from some feverish complaint has promoted the formation of aphthæ, but this point has not yet been conclusively proved.

Gumboils.

Gumboils frequently arise in connection with an aphthous condition, but there is always a decayed tooth which has some decomposing matter in its substance. The discharge from the inflamed part must be promoted by washing the mouth with warm water, and by holding the water in the mouth for a few minutes at a time. A soft fig, made quite hot in the oven, then cut in half, and the soft side applied over the boil, so as to avoid absolute pressure on the tender part, and kept in position as long as possible, will be the most comfortable way to apply a poultice. If the pain continues to be very acute the surgeon's lancet may be the best remedy, and after the inflammation has subsided, the carious or necrosed tooth should be removed if it continues to be tender to the touch. If the tongue is foul and the breath offensive, it will be right to administer a simple aperient, such as a dose of Gregory's powder, or some fluid magnesia, or even an emetic, if the stomach is loaded with undigested food.

Toothache. *Teething and Toothache.* — Gumboils frequently accompany toothache. The acuteness of the pain of this agonizing disorder is often relieved as soon as swelling takes place. When this is the case it indicates peri-dental inflammation, that is, an inflammation in the membrane covering the fang of the tooth. It is generally connected with some constitutional disorder, as a cold, or other disturbing cause. When there is acute pain on touching the tooth, warm fomentation in the mouth, and protection from outer cold, is the best treatment. The sufferer will find breathing through the nose (rather than the mouth) to be the best way to draw in air, for a draught of cold air impinging on the exposed nerve is a source of pain. Irritating applications, such as creosote or spirits of any kind, which are often used to allay pain, are of no service whatever. They only add to the mischief; although they may relieve pain for the moment, it is sure to return again more severely than before. Swelling of any kind near to a tooth should be treated, if tender, with fomentations, and liquid food taken until the boil has softened and discharged. If the tooth is hollow or carious, the pain sometimes may be relieved by picking out of the hollow tooth some small particle of decomposing food, or some portion of hard matter which presses upon the exposed and inflamed nerve. Even by protecting the latter from the air by inserting a flake of cotton-wadding, soaked in some disinfectant and inserted very carefully, so as to avoid all pressure upon the nerve, we may save the little patient some suffering. If there is extending decay in the tooth it may be arrested by active astringents or stimulating applications, such as creosote, camphor, or essential oils; but all these kinds of applications are of doubtful utility in the end. They relieve pain for the moment, but it is sure to come again. Soda will arrest fermentation for a time, and so may ease suffering when it arises from that cause. All these actions indicate decay in the teeth, and require the care of the dentist to arrest their extension.

Treatment.

Loose teeth should always be removed, as they only cause irritation in the gums, and interfere with the formation of healthy saliva. They prevent the child from masticating his food properly, and lead him to swallow it uncomminuted, and thus throw a duty upon the stomach which it is not always able to perform. There is consequent indigestion, and with it an inability to do the mental task which the rules of the school require to be done. The child is then blamed improperly and unjustly. He knows that the fault is not altogether his own, and so a loose fang may be the first cause of mutiny and disorder among the scholars. These latter conditions, when they arise, are generally founded upon some concealed injustice in school-life, as well as in the weightier arrangements of state government, and concerning which the actual governor is too often ignorant.

It is necessary for the schoolmaster to be aware of the fact that dyspepsia, headache, relaxed throat, cough, croup, and even convulsions may be simply dependent upon a decayed or cutting tooth. Fœtid breath very often indicates a number of decaying teeth in the mouth. If food is left for a few hours in a hollow tooth it is sure to become more or less putrid, and serious disorders or continued bad health may be produced by a small particle of decaying animal matter in a hollow tooth.

Fœtid breath caused by bad teeth.

Dental surgeon required for all large schools.

Large schools should always have dental officers attached to them, who by a periodical inspection of the teeth of the children will be able to avert decay, remove loose fangs before they produce general disorder, and this may be the means of stopping the progress of much dental mischief.

Tartar.

The deposit of so-called tartar upon the teeth is always a matter which requires attention. The deposit is various in its constituents; it consists of organic as well as inorganic matter; there is *débris* of food as well as *débris* of animal life; its presence depends upon a constitutional as well as a local cause. If removed it often rapidly forms again. The cause must be corrected by an attention to the condition of the digestive organs, and a rapid removal of the collected tartar, especially when, as is generally the case, it is accompanied by fœtid breath. The varieties are numerous, but the majority can be easily remedied by the proper use of disinfectants. If there is any inflammation or sponginess of the gums, or tendency to hæmorrhage, each must be treated independently of the formation of the tartar: and it is probable that if the one condition is removed, the other will cease. Hæmorrhage, or bleeding from the gums, is sometimes an evidence of improper feeding; fruit and vegetables have been withheld, and a scorbutic tendency set up, which shows itself in loosening teeth and bleeding gums. The signs of mischief may be observed by the master, when the parents have not seen them, or have mistaken their significance. The state is one which can only be remedied by an alteration of diet, by a restoration of those kinds of food which nature requires. The aggregation of people in dense numbers, such as takes place in large cities, is a great impediment to the supply of fresh fruit and vegetables; and yet such food is necessary for healthy digestion. and a proper development of the second set of teeth.

Bleeding from gums.

When a teacher observes the state mentioned, it would not be out of place for him to send a line to the parent, and suggest more fruit and vegetables and less animal food or pastry for the child. The removal of a tooth is occasionally followed by considerable bleeding; when there is constitutional tendency, it will be good for the child to take lime-juice, as well as well-cooked green vegetables, so as to remove the tendency to hæmorrhage, and to obviate further evil.

Tooth-brushes and tooth-powder.

I am sometimes asked if tooth-powder is a necessary thing for a child to use, and how soon tooth-brushes become necessary articles for use in the bedroom. It is wise to clean the teeth with some antiseptic powder, such as finely levigated chalk or charcoal, whenever the teeth are decayed, but ordinarily with undecayed teeth too much friction with the brush is to be avoided. It would be best to wash the mouth out, and to gently clean the teeth at bedtime, so as to remove decaying food from between the teeth and out of the hollows before it has had time to decompose, rather than leaving it all night in the mouth, and so causing offensive breath. This is the principal use which renders a tooth-brush an advantage, which does not arise from the friction which is so often advised. You will not keep the teeth white by brushing them severely, but you may assist in doing so by removing decaying food from between them, and keeping the digestive organs in good order. This part of the subject will be considered more in detail when treated from its medical aspect.

CHAPTER VII.

EFFECTS OF BURNS, SCALDS, AND CORROSIVE ACIDS.

Burns, scalds.

THERE is nothing so terrifying as a person on fire. The moment a child is in flames it loses all power of control, and but too often common-sense is lost among those who witness the misfortune. The mind appears to be paralysed. If a child is seen to be in flames, wrap something round it as quick as thought, and throw the sufferer on to the ground; if nothing else is at hand, take off your coat, or a mat, a table-cloth, anything which will not burn rapidly. If nothing is at hand, roll the child over and over on the ground, but don't let it run about. If it is your coat which is used, or whatever else it may be, press it lightly down and smother the flames; they will then extinguish themselves. Recollect that the child must be made to lie down and kept on the ground, and not allowed to stand upright. If water is at hand so much the better, but don't let the child run some distance to a water supply; make it lie still, and let some one fetch the water to it, if they like. The accident happens more often to girls than to boys, from the more inflammable nature of their clothes. As soon as the fire is extinguished don't proceed to pull off the burnt articles. You may get some water and moisten the burnt part, because there

What is to be done.

Laid on ground.

may be smouldering fire ready to burst out again if air be admitted. If you are certain that there is nothing which can do so, don't use the water at all; be careful not to expose the burnt part to the action of the air, and if possible keep away all cold air. The burnt material is the best covering that can be used; it is charcoal, and an antiseptic of itself. It is a serious error to clear off all the burnt substance. As soon as the fire is perfectly extinguished, cover up everything as quickly as possible that does not come away without tearing. If the clothes are soaked with water, this is not so easy. If, therefore, water has not been used, so much the better for the ultimate result. It is astonishing how the evil consequences of burns diminish when these rules have been observed. If water is at hand, of course it should be at once used to extinguish the fire, as being most rapidly and immediately effective; but it is worse than useless to apply water after the fire has been extinguished; and then to tear off the charred clothing, bringing the skin with them, is bad treatment. Cut the clothing away and leave the adhering parts *in situ*.

Not to strip off burnt clothes.

The succeeding treatment resolves itself into three sections. First, that to be adopted to remove the incidence of the shock to the system, which is usually great; second, that for the immediate treatment of the burnt part; and third, the subsequent course to be adopted to cure the burns. The shock is sometimes so great that life is lost, without any attempt at rally being made. Examine the hands and feet; if they are cold, and if there is scarcely any pulse to be felt, it may be advisable to adminster a few teaspoonfuls of brandy and water every few minutes until the pulse returns. Use hot bottles to the extremities. If a

Remove shock.

cup of hot tea can be rapidly obtained it will be better than the alcoholic liquid, and not afterwards have any injurious consequences; indeed, it will be beneficial in all cases. If there is a continuous exhaustion, a little sal-volatile in water (a teaspoonful in a wine-glassful) will be useful. It is more rapid in its action than the brandy. If there is not much shock, a little cold water will be better than either brandy or sal-volatile. The remedies should be used as soon as they can be obtained; in the meantime, preparation should be made for local treatment. The principle to be aimed at is to cover up the burnt part as quickly as possible from being acted upon by cold air. Sheets of wadding are the best covering, the woolly side being placed next to the burnt part. If there are blisters they should not be interfered with; they should be kept, if possible, from injury, as the serum and detached cuticle is the best covering that the raw surface can have. It protects the cutis until it is capable of protecting itself. If it is necessary to remove the soaked matter, or if suppuration should afterwards be established, then carbolized oil should be freely applied, and cotton wadding again used. If neither wadding nor carbolized oil are at hand, the burnt part may be covered up with flour, and loose bandages should be applied to keep it on the burn. Linseed oil and lime-water are sometimes applied, but they are inferior to cotton wadding and carbolized oil.

Treatment of burnt part.

It is astonishing how rapidly burns will heal if the air is kept away, and the blisters are not interfered with, provided the cutis has not been completely destroyed.

Keep air away from burnt surface.

As soon as the dressing is completed, and the child is in bed, if the pain continues to be excessive, ten grains of chloral in sugar and water may be given to a child ten years old, provided reaction has taken place. If it is a younger child, a grain may be dropped for each year. The dose may be repeated in two hours if it does not produce refreshing sleep. It is better to give a full dose at once, though some practitioners recommend a smaller dose at shorter intervals. If chloral is not at hand, a few drops of laudanum may be given, a drop for each year, according to the age of the child.

Antiseptic dressings.

The dressings are not to be interfered with for several days, and in the meantime milk is the best diet, with eggs and beef-tea. Solid food is to be avoided until there is complete recovery, and the wounded parts have cleared from all sloughs. If the mischief has penetrated deeply there will be considerable sloughing, but carbolized oil diminishes the smell which used to come from such injuries before antiseptic dressings were in vogue; these decrease the resulting mischief very materially by excluding the septic germs which abound everywhere. If there is a large granulating wound, it may be treated with slips of lint spread with Turner's cerate (compound calamine ointment), alternating now and then with water-dressing, and sometimes using a solution of sulphate of zinc, soaking a piece of lint the same size as the sore, and placing the wetted lint directly on it. When the granulations are very florid and luxuriant, the parts affected must be kept perfectly quiet and not exercised in any way, by which the tendency to contraction, which so often disfigures the victim, will be diminished.

The longer the first dressings are kept in their place the better. If there is no swelling and no offensive discharge, they should be continued as long as possible and not interfered with; length of time being no argument for removal, if other things do not call for it. The treatment must be regulated according to the part affected. The joints and the parts about the neck are those most liable to be disfigured by contraction. The greatest care is to be taken to avoid unnecessary movement, but whenever a flexure has its opposing surfaces burnt, the opposite sides must be kept apart and the greater care used to prevent adhesions and contractions.

Scalds—treatment similar to that of burns.

Scalds.—The results are very similar to those produced by fire, and the treatment is of a similar character. We must take care not to drag away the skin with the clothes; cut them away very carefully. In taking off a shirt, or a stocking, or a coat, the skin is very easily brought with it. Blisters must not be broken, and the best protection the cutis can have is the skin which is raised over it by the serum. Instantly envelope the scalded part in wadding, and treat it afterwards with carbolized oil, just as directed for burns, whilst the shock of the pain and the after treatment is precisely similar. The most painful results sometimes follow from accidentally taking a draught of boiling water. All that can be done is to get the patient to swallow salad oil, or perhaps the surgeon may find it advisable to perform tracheotomy, that is, to open the throat below the larynx, insert a silver tube, and allow the breathing to be continued in that manner until the swelling in the mouth and gullet has subsided. Usually, however, no kind of treatment is satisfactory in its ultimate results, and the patient dies from asphyxia or suffocation.

Corrosive acids.

CORROSIVE ACIDS produce very similar results to those which boiling water sets up in the throat, when they have been accidentally or designedly swallowed. *Sulphuric acid* (or oil of vitriol), *hydrochloric acid* (or spirit of salt), *oxalic acid*, *carbolic acid*, *nitric acid*, *corrosive sublimate*, *chloride of zinc*, etc., etc., are the more common poisons which act by destroying those parts of the body with which they come into contact. Chalk, magnesia, lime, mortar scraped from the wall or ceiling of an ordinary room, and mixed with water, and syringed into the mouth or on to the burnt part, are the more easily available antidotes. Corrosive sublimate poisoning is treated best with white of egg and milk; but for the corrosive acids chalk is the best antidote. It must be used as quickly as possible. After all trace of acid has been removed, the part should be kept covered with salad oil, which should be carbolized if the mischief is outside the mouth. *Caustic alkalies* and their carbonates act somewhat differently to the acids. They do not effervesce when they touch the ground and come in contact with stones and lime compounds, as is the case with the corrosive acids; this result may be used to diagnose the nature of the poison which has been used. The best antidote for the caustic alkalies are lemon juice or vinegar, afterwards olive oil and milk. The stomach pump is not on any account to be used in such cases, for the passage of the tube would be sure to inflict further injury upon the corroded parts. The nature of the acid is not of much importance, and whether it is potass or soda which has been taken is of no moment; in the one case—that is, acids—chalk, lime, or magnesia must be given, and in the other—in poisoning by alkalies—vinegar or lemon juice, or any vegetable acid in solution.

Treatment.

CHAPTER VIII.

DROWNING.

Drowning.

THIS is a very frequent accident among schoolboys. It may happen to the very best swimmer from various circumstances, although a boy who knows how to swim will be much less liable to the danger. It may be worldly wisdom to adopt the determination of the man who declared he would never go into the water until he knew how to swim, but it is not a pleasant thing to see a fellow-creature in imminent danger of death, and feel oneself utterly unable to assist him because of one's ignorance of the art of swimming. Every boy and girl ought to be able to swim, so that he or she may not feel in after life that they might have saved a fellow-creature's life if their education had been conducted properly. The mode of death varies. It may be caused by drunkenness or by concussion, the head striking against a rock or post in the water; it may be caused by fright, producing syncope or fainting, or an epileptic fit may have preceded the fall into or come on after immersion in the water. There may be paralysis of the muscles of respiration, or some disease of the heart may have given rise to the fatal result; all these conditions may prevent recovery, although the body is taken out of the water very rapidly. The human body has

Causes of death.

Why body sinks in water. a specific gravity slightly greater than water, so that under ordinary circumstances it sinks to the bottom; but a very little air in the alimentary canal, or a full inspiration counteracts the slight difference between them. An inexperienced person exhausts himself by exertion, whilst the calm and self-confident one is able to keep his head above water for some time. Swimming is easier for a fat person than a thin one, and there is less danger of death from asphyxia or suffocation, which is the way in which death arises when it is caused by immersion.

Treatment. The treatment to be adopted to recover a drowned person may be based upon five different headings: first, to restore animal heat; and second, stimulate the heart to recover its lost power; third, to carry on artificial respiration; fourth, excite or renew nerve action; fifth, combat the after consequences which may follow from the immersion. Death is much more rapid in winter than in summer, in consequence of the greater coldness of the water, and water is one of the most rapid abstractors of animal heat from the body. It is necessary, therefore, to get the body as quickly as possible divested of all wet clothes, and have it thoroughly dried. Place it for a few seconds face downwards, with the head lower than the feet, with the mouth open and the tongue drawn forwards; then turn the body on its back,—if it can be placed upon a board or a shutter so much the better.

Sylvester method. Artificial respiration is carried on best in a combination of what is called the Sylvester method and that which is recommended by Dr. Howard, of U.S.A. Grasp the arms at the elbows and draw them forcibly above the head, having first raised the shoulders by means of the squab of a sofa, pillow, or bolster, or, what is much more likely to be at hand, a bundle of clothes rolled up, so as to raise the front of the chest for about seven or eight inches higher than the hips. Keep the arms on the stretch above the head for three or four seconds, and then reverse the action, pressing the arms against the ribs, by which the breast-bone is raised. Continue this movement about fourteen to sixteen times in a minute. As you raise the arms above the shoulders, an assistant should forcibly press down the sternum or breast-bone, so as to empty out of the lungs as much air as possible, and thus imitate as closely as can be done the action of the respiratory muscles. Whilst this is being performed, not too quickly, others should apply hot flannels, or bricks made hot in the fire, and wrapped up in flannel or other material, so that as much external heat may be applied in as short a time as possible. Do not give up your movements until it is certain that life is absolutely extinct. The effort may be continued for an hour apparently without success, but it may at length succeed. So long as warmth can be kept in the body, the method must not be given up. Be careful not to make the extensions too rapidly; twelve to fourteen times in the minute are more likely to succeed than eighteen or twenty. If there is evidence of life, a steady, gentle perseverance will probably be rewarded. If there is a galvanic battery at hand, it may be used to promote the contraction of the cardiac muscle; one pole of the battery should be applied to the epigastrium, that is, the space just below the apex of the heart, on the left side. The other should be placed on the nape of the neck, occasionally changing it to the front side just above the collar-bone. It should not be used for more than a minute or two at a time, as it might be hurtful rather than otherwise, if good results did

May be continued for an hour.

Galvanism.

not at once proceed from its application. As soon as respiration is fairly established, it is better to leave the patient to himself, provided a proper colour has appeared in the lips and face. A cup of hot tea may be given as soon as the patient can swallow, but the administration of large quantities of brandy and water is not to be encouraged. As soon as the patient can swallow, it is evident that there is returning vitality, and hot tea will be far better than the more violent stimulant which is usually poured down the unfortunate victim's throat; until the power to swallow has returned, it is worse than useless to attempt to give anything. I have seen serious inflammatory action result from a little spirit finding its way into the larynx instead of the gullet. The spasmodic action which this proceeding is likely to excite will be probably a means of extinguishing a spark of life, by stopping the act of inspiration, as by the contrary effect. Alcoholic stimulants may be useful in cases in which the heart is weak, and a rapid relief is required to remove the livid state which the lips and cheeks exhibit, but if there is a florid freshness, which is usually the case when the sufferer has previously been in good health, and is about to recover, tea will be far more satisfactory than brandy. If there is any tendency to hysterical sobbing, a teaspoonful of sal-volatile in a glass of water will be the best restorative.

Brandy after mischievous.

CHAPTER IX.

ARREST OF RESPIRATION.

Srangulation or Suffocation, Suicidal or Accidental.—Arrest of respiration occurs in several ways. It may be by causes connected with suicide or accident, or with diseases hidden in the brain case or some other part of the body. The conditions are very similar. It has occasionally happened that a boy has been accidentally hanged. Several such cases are mentioned in works on Forensic Medicine. Scott, the American diver, hung himself by accident in public, and no efforts were made to save him until too late. Children have often been found suspended in such ways as have pointed to the accidental nature of the result; but instances are not infrequent of children committing suicide by hanging themselves. Those in charge should know, therefore, the proper course to be pursued in such cases. Death may be produced by asphyxia, either by strangulation or by suffocation. In strangulation the pressure of the cord upon the windpipe closes the air-passages. But death may arise from apoplexy, the pressure of the cord stopping circulation through the vessels, but not completely closing the windpipe; or it may be caused by fracture of vertebræ, and rupture of, or damage to, the spinal cord. The latter condition occurs when the body falls from a height, as happens when a

Strangulation causes death by asphyxia, apoplexy, or paralysis.

person undergoes the last penalty of the law. In the latter case death is immediate; in the former it may be some time before that result arrives. It is not necessary, in order to ensure death by hanging, that the feet should be off the ground. The pressure upon the vessels may be sufficient to give rise to apoplexy or death by asphyxia, even when the toes touch the ground. In other cases a person may faint in consequence of fright, or from other causes, and a tight ligature round the neck may accidentally become tighter and cause death by strangulation. Death may arise, therefore, from three different causes, of which a ligature round the neck may be the prime factor. In all cases of hanging, the first thing to be done is to cut down the victim. It is curious, but this is not always done by the bystanders. People often run for assistance instead of at once cutting the cord, or raising up the body so as to loosen it between the neck and the object to which the cord is attached. It has happened on more than one occasion, that companions have run away for help, and left their friend to his fate, when a moment's thought, such as placing one's head and shoulders between the hanging person's legs, and raising him up, so as to take the pressure off the cord, would have saved the sufferer from his untimely fate. If there are two persons at hand, one should do this whilst the other procures a knife or some other sharp instrument, if he has not one in his pocket, and cuts the cord as quickly as possible. Then all tight clothing about the neck and chest should be at once removed. If, as is probable, the head and face are frightfully congested, cold water may be dashed upon them, whilst the hands and feet are kept warm and dry. If a smelling-bottle or salts

Cut down at once.

Loosen cord round neck.

of ammonia are at hand, they may be applied to the nostrils. But the most important thing to be done is to use artificial respiration in the same manner as is recommended in cases of drowning. It might be beneficial in certain cases in which apoplexy is imminent, for some blood to be taken from the arm, or even from the jugular vein; but this can only be done by a skilful surgeon. The indications are to set up respiration and to relieve the overloaded vessels, whilst cold effusion may be beneficial in emptying the gorged vessels in the head. If blood is taken, it must be by a free blood-letting, for it is more for the purpose of relieving the pulmonary circulation than the threatening apoplexy. As in drowning so in hanging, there may be syncope or fainting, which may have preceded the act of strangulation. It is necessary, therefore, to continue artificial respiration as long as the least doubt remains as to the result. The heart may continue beating in a very indistinct and inaudible manner, long after the pulse has ceased to be felt, or the breath to be perceptible to ordinary observers. Be careful to free the mouth and throat from any possible foreign bodies. Death sometimes results from direct strangulation, by the forcible compression of the neck by thieves on the highway, and which goes by the name of garotting. In these cases insensibility results from asphyxia or syncope; asphyxia results from the impediment to proper aeration of the blood, whilst syncope is the result of either fright or shock to the cardiac nerves. It is sometimes said that some anæsthetic, such as chloroform, had been used to aid the operation of the thief. But this is imaginary. There is no anæsthetic in common use which can be of any service in the short time at the command of the thief;

Artificial respiration.

Release loaded vessels.

Chloroform is not used by thieves.

and when victims have detailed such an event, it has been imaginary and not real. No reliance is to be placed upon the statement of those who assert that they were chloroformed before they were robbed.

Suffocation by choking.

Suffocation by choking.—Accidents of various kinds may produce this result. I have known of more than one instance in which a lump of meat has gone into the trachea (or wind-pipe), instead of the pharynx (or gullet), and death has resulted. In every case of supposed apoplexy, or of any kind of fit, it is right to examine the throat, especially if the individual was eating at the time of the supposed fit. Suffocation results whenever air is prevented from entering the air passages. Children are often suffocated in bed by the clothes being drawn two tightly over their mouths, either by accident or design. Coins have been put into the mouth for various purposes, and have accidentally passed into the larynx, and have produced suffocation. Pepper has led to choking by being drawn into the wind-pipe. When suffocation results from the presence of a foreign body, such as a lump of meat, or coins, or such like, introduce the finger into the throat as quickly as possible, and displace the offending body. A tallow candle may be used with effect to push it down, if it is something which sticks in the gullet and compresses the wind-pipe. If the foreign body has entered the trachea, there is nothing to be done unless a surgeon is at hand to open the wind-pipe, and allow of respiration by that means. When suffocation is supposed to have resulted from smothering, artificial respiration and removal into fresh air are the proper means to be adopted in all cases. It is especially necessary to be sure that no foreign body is present in the throat. as a very small matter at the top of the wind-pipe

Foreign bodies in wind-pipe.

may excite spasms and close the passage. If a candle is not at hand, a feather may be used, or any soft body which may act by displacing the offender. When a fish bone is the cause, it may be picked out by a pair of tweezers, or pushed down by the handle of a spoon. If a coin has entered the trachea, it might be beneficial to place the patient with heels upwards, so as to allow the foreign body to drop back again by its own weight.

Action of Poisonous Gases.—The fumes of burning charcoal, the fumes from faulty stoves, the escape of coal gas into bedrooms, and of gases which are produced for the purpose of chemical experiment, sometimes give rise to serious accidents, and may cause death by suffocation. The indications for treatment in such cases are, to get the patient into the fresh air, to promote respiration by artificial action, to relieve the venous congestion, supply fresh air, and to combat the tendency to death, according as it appears to be from asphyxia, or apoplexy, or syncope; bearing in mind that the danger in asphyxia is the absence of air in the lungs, and that there must be a free current of air around the patient, whilst artificial respiration is performed as regularly as possible; that the crowding of a number of people around the insensible person is increasing the danger; that pure air is a necessity. **Asphyxia.** In asphyxia there is suspension of animation, with flushed or livid face, staring and congested eyes, and veins full to bursting, but pulse scarcely perceptible. **Apoplexy.** In apoplectic tendencies there may be similar conditions, with stertorous breathing, that is, a noisy kind of breathing and flapping of cheeks, with a full pulse; artificial respiration will not be useful. **Syncope.** In syncope there is pallor rather than lividity, and death-like coldness, the limbs are flaccid, and the pulse, though extremely feeble and thread-like, may be felt occasionally. Artificial respiration is not so necessary as warmth and quietness, whilst the gentle application of ammonia to the nostrils, a little hot tea or sal-volatile and water by teaspoonfuls into the mouth, and the recumbent position, with an instant removal of all tight clothing, are the best means to be adopted to restore the suspended animation.

Cerebral or Brain Disturbance.—This class includes a number of cases which are pathologically and medically incongruous; but to the non-professional eye are very similar: they may be caused by accident, or arise from disease or design.

They are—*Concussion of the Brain*, from shock, either mental or physical. *Compression of the Brain*, from fracture of the skull-bones, or effusion within the cranical cavity. *Coma*, or unconsciousness, which follows *Epilepsy*, or a certain kind of *Convulsion*, and the insensibility of *Intoxication*, on the sequence of *apoplexy.* Suspended animation of *syncope.* Some *hysterical conditions*, which may simulate either of the above, and *Catalepsy*, or *Trance.*

Coma.

Convulsion.

Trance.

I propose to note the signs which distinguish the one from the other, and also the treatment to be pursued in each kind.

Concussion of brain.

Concussion and Compression.—A person has a blow upon the head, as by falling down stairs, or from the branch of a tree; he may have fractured his skull, and some of the bony covering may have been pressed into the brain substance, or he may be suffering only from the effects of concussion. The blow may have temporarily suspended circulation through the brain, and the development of nerve force is stayed without having produced any physical damage to nerve substance. The symptoms of both concussion and compression are similar in the first stage. There is total insensibility; the pulse is feeble, perhaps intermittent, and the extremities cold. If death is not immediate, there is, after a short time, a slight warmth over the body; the pulse becomes more perceptible, and the breathing is sighing and irregular. Sometimes a vomit takes place, especially if there is fresh food in the stomach; the patient may talk for a short time in an incoherent manner, then open his eyes, which were closed, looks round with an astonished expression, and becomes himself again. This stage may occupy a few minutes, or it may last for some hours, and the patient come out of it very gradually. Slighter cases of concussion simply stun the patient for a short time only. Vomiting is not a serious sign in severe cases; it is sometimes more significant in those apparently slighter cases, in which the patient expresses himself as all right again, and determines that there is nothing the matter with him. Great care is necessary in such cases to avoid excitement, to avoid heavy meals, and to get quiet sleep. Inflammation of the brain may arise from the effects of the concussion, or there may be fracture of the skull from *contre-coup* without displacement. When such is the case, there is headache, occasional vomiting, then feverishness, a stupid-looking state supervenes, and coma, or insensibility, comes on either gradually, or suddenly after a convulsion. The symptoms which indicate compression may be manifest from the first, in consequence of the state of the skull-bones, or from considerable bleeding from the ear, which is indicative of a fractured base of skull. In simple concussion there is no stertorous breathing, and the pupils are not irregular, and they act when light is thrown suddenly upon them; whilst in compression one or both pupils may be widely dilated, and

Compression of brain.

Fracturod skull.

are not sensible to the influence of light. When a person is first found, whether suffering from concussion or compression, he must not be raised up, but kept in the recumbent position, with the head raised not more than three inches from the ground on a wedge-shaped pillow, which may be made by a few articles of clothing or a folded blanket. In carrying such a case to the nearest house or place of refuge, great care must be used to avoid any increase to the damage by injudicious movement. If a stretcher can be procured from the nearest police station, so much the better; but failing that, it is easy to make one by means of a couple of poles, with a stout blanket, or a horse-cloth, or any material which can be attached to the poles, and tied by string, or rolled round them and stitched together, so that the latter are about two feet apart, and the patient then placed lengthways upon the cloth and carried by four persons, as bearers, not raising the patient on to the shoulders, as is usually done, but keeping the poles at some eighteen inches from the ground, and the bearers stepping together so as not to jar the patient. They should carry him head foremost, and arrange for the taller persons of the party to take the foremost places. It is sometimes difficult to keep the poles from falling together; this may be obviated by two cross-bars between them about two feet long, which may be obtained from a forked branch of a tree, if a saw is not at hand to manufacture one from a piece of board. It is highly mischievous to place an injured person in a cab or cart for conveyance to the hospital, or to the house, unless a proper arrangement has been provided, such as is in use in the ambulance waggons attached to the military service. The stretcher is by far the best means of conveyance in all cases of accident or un-

How to make a stretcher.

consciousness. The fresh air which is obtained by movement will often be of service, whilst if care is used by the bearers to step all together, and the patient kept in the recumbent position as advised, no increased mischief will result to the case, whether it be from unconsciousness or fracture of any bone. Long-continued quiet, simple diet, and freedom from all exciting conditions, are especially necessary in all cases in which the head has been injured.

Ambulance drill.

Every large school should have instruction in this method of carrying injured persons. The medical attendant should be asked to advise the boys upon it; an occasional ambulance drill, in which a boy should be carried on an improvised stretcher, and the bearers taught to step together and carry their companion without jerk and by a steady movement, would save much suffering to the actually injured, and would be of more service in after life than much of the knowledge which is ordinarily taught in schools.

Difference between drunkenness, epilepsy, and apoplexy.

The *Coma*, or unconsciousness from *apoplexy*, *epilepsy*, from *opium* or *drunkenness*, are difficult to recognise, or rather to diagnose the one from the other. If the two last are suspected in consequence of the smell of the breath, it is right to use the stomach pump, so as to withdraw the narcotic which may still be in the stomach, and prevent further absorption, and a medical man should be sent for to do this as quickly as possible. The skin is generally warm and dry and the pulse quick if the drunkenness is recent. The person can be roused somewhat; but in the coma which has been caused by apoplexy, or that which follows epilepsy, there is perfect unconsciousness, the pulse is irregular and slow, sometimes full instead of small. There may be flapping of the cheeks, and dilated or irregular pupils of the eyes. If it is the sequence of an epileptic fit, there is a leaden aspect of skin, which is cold, perhaps clammy, and some bloody froth may be about the lips, showing that the tongue has been bitten. The coma from epilepsy is sure to pass away if the fits do not recur; it is quite unnecessary to give anything in any of these cases except a little cold water. The mischief which may be set up from forcing stimulant down the throat of a semi-conscious man or child, is sometimes very great. Leave the patient in the recumbent posture, unfasten everything which is tight around the throat or the waist, keep the feet warm, and wait until the doctor arrives and indicates the proper thing to be done. More mischief is done by meddlesome assistants in these cases than can possibly arise from doing nothing. In opium poisoning the pupils are contracted, the pulse feeble, the respiration slow, and the skin cold; the patient may be roused, and must not be allowed to sleep; he should be made to walk about until the stupor passes away.

Hysterical faints.

A hysterical faint and cataleptic unconsciousness will be recognised by the quivering eyelids and lips, and the absence of those signs which indicate danger in the cases previously mentioned. Such cases are better let alone, giving fresh air and effusing the face with cold water, and loosening all ligatures in clothing, but not wetting the dress. Cataleptic cases are not uncommon among schoolboys and girls; there is complete rigidity of the extensor muscles, the jaws are fixed and the eyelids closed and the skin cold (in hysterics it is warmer). When such cases occur in schools they should be transferred to the care of their friends, otherwise unconscious imitators may be found, and the disease become intractable. There is no immediate danger to the child, and it is not often that the fit comes on when no one is present to observe it.

Trance.

CHAPTER X.

DISLOCATIONS AND FRACTURES.

Dislocations.

DISLOCATIONS are terms which are applied to displacements of the bones, which go to form a joint, when the natural position of a bone to its fellow is altered, and the joint between them rendered useless. They may be simple, as when there is no other damage than a more or less severe rupture of the surrounding ligaments (as the bands which connect them together are called), or they may be associated with fracture of some of the bony structures which enter into the formation of the joint.

Complete and incomplete

A dislocation is said to be *complete* when the end of the bone is altogether separated from its fellow which made up the joint. It is *incomplete* when it is a partial dislocation only. Dislocations are of very frequent occurrence among schoolboys. They are generally caused by sudden falls or severe blows, so that the force of a muscle or the direction of the blow is suddenly brought to bear upon the head of the bone, deflecting it in a direction in which there is not sufficient strength in the envelopes to resist the force. The head of the bone is in consequence forced out of its socket or resting-place. They are simple when there is no injury inflicted upon the surrounding skin or muscles. They are compound when the integu-

Simple or compound.

ments are torn, and there is blood effused externally through an open wound. They may be associated with fracture, the bone itself being broken either in its shaft or immediately into the joint: these latter, when compound—that is, when the interior of the joint communicates with the external air—are always of most serious consequence.

There are some general symptoms which belong to all dislocations, such as pain more or less severe, according to the extent of the luxation, the injury to the soft parts, and the sensitiveness of the patient. The limb cannot be moved, or if it is moveable it is very painful to move it. There is a depression in one place, and an unusual lump in another. The position of the limb is different to that which is natural to it when at rest. It should always be remembered that dislocations are more common among children as a result of a particular fall or injury. A similar fall or injury is more likely to be accompanied by fracture in old people. This arises from the fact that the bones are more brittle in age than in youth. They have more of the lime salts and fatty matter in their composition, with less gelatine, whilst the opposite holds among the young. Dislocations occur most frequently in the following order:—*The Shoulder; the Wrist, Fingers, and Thumb; the Ankle: the Elbow; the Collar-bone; the Hip; the Knee and Knee-cap; the Jaw.* There are some minor forms which are very infrequent, and some more serious, as when a vertebra, or one of the bones of the neck or back, is displaced. In the latter case it is usually accompanied by immediate death, and need not be considered here. The treatment in all kinds of dislocation is more or less similar in some of their parts, so that a few general directions may be given. The

Forms of dislocation.

cardinal line is that all dislocations should be reduced as quickly as possible. A luxation which has existed five minutes only is a trifle compared with a similar case in which the dislocation has been unreduced for twelve hours. Every hour during which the bone remains out of place increases the mischief; inflammation arises, and with it a tendency to spasm, and to tension in the surrounding muscles. Reduce the dislocation if possible before the patient recovers from the shock of the accident; it is an easy thing to do if done at once; it becomes very serious if it be left for some time unreduced. The reduction may be effected by any one if it is recognised immediately and the right course adopted; but if left until to-morrow, it is only the surgeon who will be likely to recognise it or able to reduce it.

General symptoms.

Dislocation of shoulder.

Dislocation of the Shoulder.—This may take place in three different directions. The head of the bone may be thrust forward upon the chest, or backward on the shoulder-blade, or downwards into the arm-pit. The elbow cannot be brought close to the side without very severe pain. There is a cavity where the roundness of the shoulder should be, and the outline is too square. If the head of the bone is forward, it will be felt as a lump on the front of the ribs; or, if backward, upon the shoulder-blade, the head is felt as a ball upon the bone, or it may have disappeared into the arm-pit. This latter is the most painful form, for the head of the bone is pressing upon the nerves and blood-vessels which supply the limb. These dislocations are easily distinguished in the thin boy, but not always so in the muscular or fat boy. If the dislocation is recognised at once, any one may easily reduce it by placing the patient in the recumbent position on the ground, then the operator pulling off his boot, sitting by the side of the patient on the side which is injured, and placing the foot in the arm-pit, and forcibly pulling at the elbow downwards with both hands towards the feet of the patient. The head of the bone will go into its socket with a snap, and the patient will be comparatively comfortable at once. If this is effected immediately after the accident, there is no occasion for the jack-towel or other ligatures which are suggested in some popular manuals. The operator's foot in the arm-pit and a strong grasp of the injured arm at the elbow, with traction firmly and continuously applied, will reduce the dislocation in a very short time, unless the head of the bone or the socket of the shoulder-blade are broken. In such cases the attendance of the surgeon must be sought before the reduction will be effected; but this kind of fracture, though common to old people, is unusual to children. As soon as the reduction is effected, the arm should be put into a sling, which may consist of a silk handkerchief hung round the neck, only just supporting the fore-arm and wrist, and keeping the arm closely to the side. It is not necessary to place a pad in the arm-pit, and bandages are not required, provided the arm is not raised.

Treatment.

Dislocation of wrist and fingers.

Dislocation of the Wrist and Fingers.—The wrist may be dislocated either forward or backward. It is seen at once by the position of the hand. Grasp the hand firmly, and let an assistant take the arm at the elbow, and each pull gently but steadily in opposite directions. The limb resumes its natural shape. It should then be placed upon a pillow, the patient sitting at a table until a proper cradle is prepared for it. This may consist of an old book-cover, a piece of pasteboard, or bit of the leather of an old saddle (pig's skin), or a piece of gutta-percha. The piece chosen should be put in hot water so as to completely soften it, then cover it with cotton wadding, and placing the injured limb upon it, mould it to the arm from the elbow to the knuckles, turning it round the outer side so as to form a kind of spout, in which it may rest when the limb is placed in a sling; bind it loosely on with a linen bandage, and allow it to dry without changing the position of the arm. It must not be put on too tightly, or it will have to be removed on account of the natural swelling which will take place. The same course should be taken with individual fingers; but in that case it is not necessary to do more than envelope the finger and its neighbour, leaving the wrist free. There may be much difficulty in reducing dislocation of the thumb. Unless it is done immediately, a surgeon will have to be summoned, and chloroform probably administered before a satisfactory reduction can be effected. Dislocation of the ankle is somewhat similar to that of the wrist, but it is usually something more. There are three bones contained in its formation. It is a common thing for the bones at the wrist to be broken in old people and to simulate dislocation; the rule will generally be fracture at the wrist in the aged, but dislocation in children from a similar accident; but dislocation at the ankle always has more or less of fracture in it, and should be treated, if possible, by a surgeon from the first. There may be displacement in four directions, backwards, forwards, inward, or outward. The lateral dislocations will be self-evident, but the anterior or posterior are more difficult to distinguish, the heel being more prominent than usual, or less so, with great pain on the least movement being attempted. These symptoms will be sufficient to excite suspicion as to its nature, and

Dislocation of ankle.

should lead the principal to seek for surgical aid at once.

Dislocation of elbow;

Dislocation of the Elbow.—Three bones enter into the formation of this joint, and, like the ankle, it may be dislocated in four directions, and will require skilled aid to effect its reduction, as it is often associated with fracture, and is a very serious injury.

Of collar bone;

Dislocation of the Collar Bone can scarcely be treated without skilled surgical assistance. There may be dislocation either at the shoulder or at the internal extremity of the bone where it rests upon the breast-bone. In either case it will be requisite to follow the directions of a skilful surgeon as to bandages and position, although, if reduced by pulling the shoulder outwards immediately, it may slip into its place and remain there, provided the arm and shoulder are fixed in that position and are not moved again for some time, a pad being placed in the armpit, and the arm bandaged to the sides.

Of hip,

Dislocation of the Hip is a very serious injury, but if recognised quickly it may be reduced by a non-surgical hand, and the patient saved much suffering. A trifling injury sometimes seems to produce the deformity which results from it. The limb is shortened, the knee stands forward, and the toes rest upon the instep of the other foot. It is manifest when the patient stands erect. A jack-towel or some similar article should be passed between the thighs, and fastened securely above the head to something which will give fair purchase; another towel is passed round the thigh above the knee, and secured with clove hitch or sailor's knot, and the other end of the second towel being placed round the shoulders of the surgeon, he places his heel in the groin, and, grasping the limb, guides it as he makes extension, until it goes into its socket with an audible snap. Every minute which elapses after the injury before reduction is effected adds materially to the pain to the patient and trouble in effecting reduction.

Dislocation of knee and knee-cap;

Dislocation of the Knee.—This accident takes place in different directions, and considerable force is required to overcome it, which must be directed by a skilled hand. It is not a very common occurrence, but dislocation of the knee-cap is not uncommon. The little bone which lies in front of the knee-joint may be dislocated to the right or left, and when recognised immediately may be easily reduced by pressing suddenly upon the edge of the bone to the outer side of the joint, so as to press down the outer side and at the same time tilt up the inner edge, and when the muscles attached to its upper border will bring it into position. If this does not effect the purpose aimed at, the leg of the patient, who is to lie on his back, must be bent as far as possible towards the face, when the leg should be suddenly bent back upon the thigh till the heel comes near to the hip. The operator presses the rim of the bone as he quickly straightens the leg again.

All dislocations require rest; warm applications to soothen the joint; no tight bandages should ever be used, but only those appliances which give gentle support.

Of jaw.

Dislocation of the Jaw is very alarming, but soon remedied if it is recognised at once. The victim finds himself in a moment after gaping, or a blow, with the mouth wide open and incapable of speech. He can only indicate its nature by signs. The operator seats the patient in a low chair, and wrapping some leather or other tough material around his thumbs, stands before the patient, and placing the thumbs as far back as possible on the back of the lower jaw, he depresses the jaw by pressing upon the back teeth; at the same time pressing the jaw forward with the fingers under the chin. If the thumbs are not fully protected they will be severely bitten as the jaw closes, but the deformity is at once remedied. It is very likely to recur in those who have been once subject to it. The use of chloroform enables a skilled hand to reduce some kinds of dislocation much more satisfactorily than used to be the case, but its use for such a purpose can only be made by a surgeon.

Broken bones.

Fractures, or Broken Bones.—There are some general directions regarding fractures which should be known to all persons having the care of children.

It would be a great advantage if ambulance classes were made a part of the work of school life, so that children might be taught some of those common-sense rules which, if always carried out, would diminish the incidence of misfortune by reducing it to its first consequences. It is very usual if a person steps off a curb, or falls downstairs, or from a tree, for the bystanders to endeavour to put him on his legs again. They take hold of him anywhere, perhaps by the arm, which may be broken; or lift him up by the shoulders, when, if his thigh be damaged, they complete the fracture, which may have been only partial; or they try to make him stand, and a splinter from a broken bone in the leg at once pierces through the skin, and makes a simple fracture into a compound one. By this means a comparatively trivial accident becomes a very dangerous one, and limb or life may be lost by the injudicious action of ignorant friends in thus trying to help an injured person to stand up. The first thing to be done when an accident happens is to keep the patient in the recumbent position until the nature of his injury is manifest; advise him to be still, and to indicate the part which is damaged. Limbs may be straightened by extending them, but in no case should any course be taken which may lead to shortening, and care should always be taken to prevent the completion of a fracture. A so-called green-wood fracture is easily kept in position. It is like a piece of green wood, it is still in apposition in some of its parts, and can only require lateral support to keep it in proper position, and will not shorten. When it is the leg or the thigh which is damaged, this rule is especially necessary to be observed; do as is generally done with horses when they fall upon a city pavement; keep the head down, until arrangements have been made for his safe transport by stretcher to his home. He must be raised very carefully to get the stretcher underneath him. First roll him on one side, and place one edge of the stretcher beneath him, and then roll him back very gently; or, if it be the thigh which is broken, lift him by the shoulders and the knees, keeping the latter close together, the legs bent upon the thighs, and with a roll of clothes beneath them, so that legs hook over the roll, and prevent shortening as much as possible. If it be the leg which is broken, the limb should be placed upon a pillow or some other soft material, raised a few inches by it, and the foot secured so as not to allow it to roll to the right or to the left. A soft pillow is the best adjunct; when it cannot be obtained, some hay or green grass arranged as a bed will effect the object aimed at.

Fractures are—(1) Simple; (2) Compound; (3) Comminuted. They are simple when there is no outward damage to the skin; compound when the bone

Fractures are simple, compound, or comminuted.

pierces through the outer skin; and comminuted when the bone is broken into several pieces. It is very important to keep the malpositions which attend a fracture within the smallest possible compass, to prevent shortening, and on no account put on any kind of bandages too tightly. A bone is generally known to be broken by the grating feeling which arises from the broken ends rubbing together, and which are quite different to any other feeling which can be conveyed to the hand of the operator. This sound is called a *crepitus*, and is quite distinctive. A broken bone should be straightened by extending the lower end until the original shape of the limb is restored. It should be secured upon or within a pillow in the case of the leg, or with soft pads in the case of the arm, until a surgeon can take charge of it. In compound fracture it is best to cover up the wound as quickly as possible with carbolized oil, so as to keep it from contact with the external air; to wrap it up in its own blood, and prevent, as far as possible, the movement of the limb until it has been properly secured.

In *Fracture of the Ribs* the treatment consists in passing a flannel bandage round the chest, so as to limit the movement of the ribs, and compel the diaphragm (that is, the muscle between the chest and the abdomen) to do most of the work of respiration. The accident is recognised by the sharp pain on inspiration, giving rise to difficulty of breathing immediately after a fall or blow.

In *Fracture of the Thigh*—a misfortune which may happen to children with brittle bones—the patient should be kept on his back, with a bolster or some similar firm support under both knees, which should be secured together until the surgeon has arranged a proper bed. Compound comminuted fractures must be treated by the surgeon as soon as possible.

In closing the second series of instructions to teachers on medical subjects, it will be manifest that it is necessarily superficial in many parts, it being only possible to indicate the nature of an injury, without further instructions. Some of the deficiencies on strictly medical points will be remedied in the subsequent section as to the Teacher's Health.

CHAPTER XI.

SCHOOL MEDICINE.

IN the preceding chapters we have endeavoured to put forward the course which should be observed, in as simple language as can be used. Besides those classes of cases, there are others which are not considered to be connected with 'hygiene,' and which cannot be included in the details which belong to 'school surgery.' The teacher too often suffers from their consequences as well as the pupils, and a knowledge of their causes, the means to be taken for their prevention, and their treatment, is personally important to him. Their management is thought to belong more directly to the physician than to the surgeon. In a considerable number of instances the conditions which give rise to them are possibly hygienic and preventable. Our object is, therefore, to lay down some rules upon general health, which may enable him to preserve his own health, and prevent the incidence of sickness and other disorders among those who are placed under his care. I propose to review the different ways in which school-life is more especially liable to disturb the bodily economy, by means of which it interferes with the comfort of the teacher, as well as being disadvantageous to the health of the pupils. This influence is

Medical aspect.

Senses interfered with.

especially liable to be felt by the different senses, and to interfere with their proper action; the body being injuriously acted upon by anything which may interfere with the proper development of any part of the nervous system, especially those deeper parts of the brain, in which the faculties of thought, of speech, of hearing, and of sight are situated. The seven senses, as they are sometimes called, will each come in for careful consideration, and the changes in action, and the diseases to which each are liable, will be in turn discussed.

They are all greatly dependent upon a properly developed and well-nourished nervous system, without which the '*Mens sana in sano corpore*' cannot be forthcoming.

Course to be followed.

I shall consider them somewhat in the following order. The growth of the body as regards the nervous system, as well as of muscular development. I shall consider digestion, especially the derangements which may arise in consequence of the use of deficient or improper food, and the character of the food which children as well as adults require; if the nourishment provided is wrong in character, the body cannot be strong or healthy. I shall consider the muscular sense as brought out by exercise, and the changes which are wrought in the body by its neglect or its excessive use. Connected with this part of the subject will be the consideration of the dangers which may arise from excessive muscular as well as mental strain, and that over-use of organs which the customs of school-life may bring about. I shall consider somewhat fully the requirements of the body as to sleep, and the conditions which give rise to sleeplessness. I propose to consider the treatment required to keep the eyesight in perfect order, and to remedy the evils to which the eyes are liable from improper treatment and over-use. The causes of deafness will be discussed, and the means which may be used to prevent or remove them. The throat and the voice will be carefully considered. The care of the mouth and the teeth will be noted. Some general directions will be given as to the use of family medicines in treating those disturbances of the general health which may not necessarily require the services of a regular medical attendant. Some directions will also be given as to the character of the clothing which children and also adults should wear as regards its incidence upon the form of the body; and I propose to give a few general directions as to what teachers should not do if they wish to live to a good old age, and to enjoy the life which Providence has given them.

A school teacher must be a physician.

It has been said that a man is either a fool or a physician at forty. That is, if he does not know how to treat himself by the time he is forty years of age he is never likely to learn; and bearing in mind the rendering of Pope in his translation of the Iliad, '*That a wise physician, skilled our wounds to heal, Is more than armies to the public weal*' (book xi., line 336), it does seem highly important that those who have to educate the young of both sexes should be able to class themselves with those who are the nation's benefactors, rather than to give occasion to others to say with Young, that '*A fool at forty is a fool indeed*' (Satire ii., line 282).

THE GROWTH OF THE BODY.

Given a young child of average health, and fairly free from the consequences of immediate hereditary disease, how is that child to be developed into an adult without the production of mischief from improper feeding? and how is the adult to continue to maintain his body in health, and provide for wear and tear in after life?

How to make a healthy adult.

'*Ex nihilo nihil fit,*' 'Nothing can of nothing come,' is as true as is another Latin proverb—'*Ex quovis ligno non fit Mercurius,*' which is freely translated into one of our own, as 'You cannot make a silk purse out of a sow's ear.'

To develop a child into a healthy adult requires a proper kind of food. This is necessary for three distinct purposes—(1) To sustain the body without diminution of the energy which it has already obtained, (2) To support its growth, and (3) To remove from it the consequences of its natural acts, or the *débris* which result from their performance. The body is precisely like a steam engine: if you wish to have it ready for use, you must keep up the steam at an expenditure of fuel; if you wish to 'conserve its energy,' you must use more fuel than is required for the simpler purpose of preparation for use. The result of these operations is the formation of ashes in the ashpit, and *débris* among the machinery, which have to be cleared away by the attendant firemen. In the case of the engine these attendants are outside its ordinary mechanism, but in the human frame they are parts of it, and are self-acting.

Conservation of energy or force.

Correlation of force.

Let us ask as to the requirements for these purposes. Mr. Grove has made us acquainted with the *correlation of force*, that light, heat, electricity, chemical affinity, motion, and magnetism are convertible; that either may, under certain circumstances, produce the other; and that neither can show its presence except by the previous manifestation of some antecedent force. To give effect to these manifestations there must be a *conservation of force*. We mean by this term a storing of power, a power of producing energy, and by energy a power of acting, *actual* energy being that which is actually at work, *potential* energy being that which is ready for work when it is wanted. We must bear in mind that there is no possibility of destroying anything in nature, and that all the changes which are incessantly going on in the body, made up as it is of millions of cells, each of which is doing something, give rise to manifestations of power either for good or evil. Sometimes there is a conservation of force, sometimes the store is diminished or even dissipated. How this comes about may be illustrated by reference to the effect of heat. If we take a pound of water at o° C., and another at 79° C., and mix them, there is a mean temperature of 39·5°. But if the first pound is ice at o° C., instead of water, the whole is still o° when the ice melted, the heat has become latent, and there is a conservation of force. Several other illustrations might be given to show how force is conserved. It may be weighed and measured. It has been so worked out by Mr. Joule, so that we are enabled to make heat and motion into convertible terms, and to measure or weigh the one against the other. Heat may be easily changed into light. Sunlight being the prime factor by means of which the world rolls along, and '*Laws wise as Nature, and fixed as fate*' continue their course as one incessant work of change. Light into heat, heat into motion, motion into electricity, the last back into light again, varying the process accordingly as it may be necessary to build up, to store for future use, or to pull down again, or to use up at once, in carrying on the functions of life. It is for these varied purposes that food is required. The natural heat of the body must be kept up to its natural standard. How this comes about is one of

Conservation of force.

those facts which are connected with the so-called vitality of the body, and which are ever likely to be beyond our ken. Why the healthy standard should be 98·5°F., why if it exceeds that standard there is so-called fever, and why death results if it is materially lowered or raised we know not.

Temperature of body in health of 98·5.

Food required for the purpose.

A great part of the daily and immediate necessity for food is to keep up the standard of temperature. Those foods, therefore, which contain the larger proportion of material capable of being burnt up in the body are those which nature dictates to us as most suitable for daily use. This class of food contains conserved energy which has been stored up and fixed in a latent condition ready when we want it. Vegetable products, for instance, have stored up a supply which has had its source from the rays of the sun ; a combination of atoms is brought about, which, when acted upon by the agencies contained in the body, set those rays free again in some other form. The carbon and the hydrogen which exists in their structures in one state of combination are made to enter into another, and heat is set free by their oxidation. Similarly our coal-fields are simply a vast magazine of the sun's rays which have been stored up in past ages for present use, and are now brought out to assist in performing all those mechanical movements which distinguish the present age from all its predecessors.

The elements which enter into the constitution of the body.

But there is a necessity for something more, oxidation alone will not provide for all the requirements of the body. The result of carbon oxidation is the production of carbon dioxide, and carbon oxidation is an action which is antagonistic to that performed by vegetable life. Vegetables absorb CO^2, and by the power of the sun's rays are able to fix the C again in the tissues of the plant, giving out the O to the air; the animals take in the O and use it in oxidizing the C and acting upon the other elements which make up the mass of animated nature. Only a limited number of those materials which are called *the elements* enter into the constitution of living bodies. Carbon, hydrogen, oxygen, nitrogen, sulphur, phosphorus, chlorine, sodium, potassium, calcium, and iron are the principal ingredients. Foods are required to provide these constituents. Their chemical constitution must be in accord with this list or they will fail to be of use as foods.

CHAPTER XII.

DIGESTION AND ITS DERANGEMENTS.

Vegetable food necessary for continuance of human life.

THE food which nature requires is derived in the first instance from the vegetable kingdom; vegetable food alone, if properly arranged, is sufficient for all the requirements of animal life. It will sustain human life until old age, and gives all the forces necessary for its perfection. It is doubtful whether the flesh of animals alone can do so. Those who live entirely on animal food suffer from maladies from which the vegetable feeder is free. The quantity of animal food which can be taken with impunity is therefore limited; whilst those who abstain from a vegetable diet suffer from diseases of a very serious kind, especially the class which is styled scorbutic, of which scurvy is the type. Eruptions of various kinds disfigure the skin, the bones are defective in toughness and strength, the teeth decay early, and the nervous system fails in vigour. There may be a doubt as to the propriety of a purely vegetable diet at all times and at all seasons. The form in which the elements exist in vegetables which are necessary for the maintenance of life is not always capable of being easily burnt up in the system, so that there may be a loss of power in bringing the correlation of force into effect, and by means of which chemical action may become vital energy.

The loss may be so great as to impair the efficiency of the machine, if it is not provided for. This is manifest in very cold seasons, in which animal fats are voraciously eaten by those accustomed to them, and even those whose stomachs used to rebel at fat are able to digest it with ease in Arctic climates. Experience, therefore, teaches us that animal diet is most useful in cold regions. It is required, even in temperate climates, for the maintenance of muscular power and the continuance of muscular exertion; whilst the health is kept up more satisfactorily in the warmer latitudes by those who limit the quantity of their meat food, and live mainly on fruit and vegetables. If there is muscular work to be done, meat food may be consumed with impunity, nay, it is required in this country; but those who labour with the brain only, or who live a sedentary life, will do better if they let the meat alone in hot seasons, and indulge very moderately in flesh food in hot climates. The reason for this is not far to seek, for although man is especially an omnivorous animal, he is so because he is intended to live in all parts of the globe. Science and experience teach him that the loss of heat from the body is small under the equator, that the consumption of carbon for the maintenance of animal heat is not so necessary, but in the more temperate climates and colder regions the consumption must be greater to enable the body to keep up the animal heat at the normal 98·5° F. For whether at the equator or in Greenland the human temperature is always about the same, seldom varying, in health, more than one degree. Now, animal food contains a much larger percentage of material available for heating purposes than does a similar weight of fruit or vegetable food. The action of cold is to

Animal fats of use in Arctic regions.

Animal food necessary in cold climates.

Vegetable food in hot regions.

check evaporation. The action of warmth is to increase it. The skin and the bronchial mucous membrane give out water, more or less, according to the temperature and moisture of the air. Fruit and vegetables contain a much larger percentage of water in combination with the elements C, H, O, which go to make up the mass of food. It is ready to meet the demand in the one case, whilst it is not wanted in the other. The chemical changes which take place allow of the production of a much greater quantity of heat from a given weight of meat than from a similar weight of mixed vegetable diet. This is less manifest in the case of wheat and other farinaceous foods than with green foods or fruits, because starchy foods have a maximum of carbo-hydrate and a minimum of water in their constituent elements; but man cannot live on starch and its analogue, sugar, without suffering in a way allied to those conditions which arise from a nutriment mainly derived from animal products. The disturbances to health are allied to, but are not the same as those caused by excess of animal food.

Change of food required according to season.

The growth of the body, and the uses to which it is put, together with the temperature of the region inhabited, or the time of year, regulate the demand for food. This demand must be considered by those who have to provide the supply, and it indicates a necessity for a properly mixed diet. All persons require more vegetables and fruit, which will provide more watery elements for the use of the skin, in the warmer periods of the year; whilst in colder seasons, the supply of meat and other animal food, such as butter and fat, must be provided in larger quantity. They will require a change of food, according to the season. To give them the same kind of diet in a wet season, when the air is always damp, and the skin scarcely acting at all, as is provided in a dry east wind, or in hot seasons, when every particle of moisture is taken up by the air, is altogether a mistake, and must put the animal machine out of gear. Abundance of water and vegetable food in greater quantities must be provided, if children, as well as adults, are to be kept in health. If their stomachs are loaded with fat food in warm and damp seasons, there will be a tendency to bilious derangements and loss of healthy appetites. The quality, the quantity, and the kind of food must be considered in relation to the habits of the person, the place in which he lives, and the time of year, as to moisture and dryness, heat or cold. The first evidence of a disturbance of the digestive organs is styled dyspepsia or indigestion. Children often suffer from this disorder from various causes besides those mentioned above. Perhaps the most frequent cause is eating too much food at one time, swallowing it too rapidly, and without masticating it properly. This fault is not limited to young children, for teachers are themselves frequently guilty of the same fault. They are hungry, and the time for feeding is limited, while food requires to be masticated properly, so that it may be ready for digestion when it reaches the stomach. The saliva must be mixed with the food to prepare it for further action lower down. Nitrogenous food is comminuted only in the mouth. In the case of starchy food, the saliva changes it into dextrine, a form which enables it to become sugar as soon as it passes into the circulation, which it does when it has been mixed with secretions from the pancreas and some glands found in the mucous membrane of the intestinal wall. All farinaceous

Mastication required.

food changes into sugar before it can be used up in the body. After this mixture, starch becomes soluble and diffusible, and passes rapidly into the blood. If the saliva is not properly mixed with the starch it does not change as quickly as it ought, and is not so quickly removed from the alimentary canal; indeed, some will pass away undigested, and its feeding power is lost. Nitrogenous matters, such as fibrine, albumen, and caseine, are changed into albuminose by the peptones of the stomach. By the aid of the peptones fibrine is dissolved and does not again solidify: albumen is transformed and becomes uncoagulable; caseine is solidified, and is then redissolved. To effect these changes two principles are indispensable, viz. pepsine, and an acid. These principles must be in proper proportion, according to the quantity and quality of the food taken. The secretions of the pancreas and intestinal glands are alkaline, and counteract the changes which the gastric acid has produced, they enable the bile acids to perform their functions and to do their portion in the process of digestion. Metamorphosis of food is necessary to enable it to be suspended or dissolved. The fats are emulsified by glandular secretions, and are fitted for absorption and diffusion through the circulation. Nitrogenous food and fat are of the greatest importance when either muscular or nerve force is required, whilst starch, sugar, and fat are required for the development of heat and its maintenance at a healthy standard. Defective mastication promotes dyspepsia, so does the use of those materials which destroy the balance of power in the stomach. Mastication is often defective from the condition of the teeth themselves. It is so whilst children are cutting their second teeth, and even when the wisdom

Action of peptones.

Nitrogenous food for musclo.

Starch and sugar for heat production.

teeth are piercing the gums a similar condition may arise. If food is swallowed in large lumps, the action of the stomach is not sufficiently active to break them down, and they pass into the intestines and set up irritation there, from flatulency consequent upon fermentation and other disorders. The action of the stomach may be likened to a pair of millstones—the food is ground up by muscular attrition; the gastric juices are then enabled to act more easily. Irregularity of time at which food is taken disturbs the power of the stomach. If the interval between each meal is too long, there may be want of digestive power; whilst, if it be taken too often, the stomach is never properly empty and healthy hunger never arises. These mistakes should be always avoided. Three meals are sufficient for healthy children above nine years of age, whilst younger children require food at more frequent intervals, because the muscular power of the stomach is not equal to the disintegration of strong meats, and absorption is correspondingly more rapid. The more soluble and the more liquid the food taken, the oftener the stomach should be supplied with nutriment. If the stomach is overloaded there is disturbance, as also if food of that nature is taken which will not allow of its disintegration. Indigestion may have many sources. Whatever destroys the balance between secretion and the food to be digested sets up dyspepsia. Mental disturbances will interfere with appetite. A man comes in from a long walk, by the aid of which appetite has been excited; he is ready for a good dinner; he opens a letter containing bad news, and his appetite is gone, and if food requiring disintegration be taken, it will not be properly digested. So a child may have a serious attack of indigestion in consequence of some fear of impending punishment.

Three meals a day required.

The more liquid the food the oftener it is required.

Sedentary occupations promote dyspepsia.

Sedentary occupations, by taking away the purifying agency of exercise, and allowing the unconsumed carbon to be deposited in different proportions in different organs of the body, is a fruitful source of indigestion; when too much carbo-hydrogen food has been taken, it seriously promotes indigestion among the great body of teachers. If a teacher suffers from indigestion, and falls back upon medicine, especially aperient doses, for his relief, without remedying the evil which has set up his malady, he is placing himself on the high road to ill-health. Depend upon it, indigestion cannot be remedied by medicine. The first cause which has set up the disturbance must be removed before the effect will cease. If food of the wrong kind, or in too great a quantity, is habitually taken, the error must be rectified. If exercise has been avoided, it must be sought for; if too small a quantity of liquid has been consumed to dissolve the effete salts in the body, and to pass them out by the proper emunctories, that error must be removed, and more liquid taken, because one of the results of life is to produce effete salts, which are the sequences of chemical action; these sequences must be dissolved and washed away.

Causes must be removed.

Alcoholic drinks promote it.

Spirituous liquors and alcoholic drinks of all kinds are serious causes for this malady. They precipitate the peptones and destroy the balance of power in the stomach, whilst they apparently increase the gastric secretion by inducing an unhealthy congestion of the gastric membranes. Narcotic drugs and tobacco lead to the same end; they produce deficiency or excess of gastric juice, and are certain, if habitually used, to lead to trouble. Acidity, whether of the gouty or rheumatic kind, may be removed temporarily by antacids, but the real cause for the acidity must be

Gouty diathesis.

searched out and rectified. If it is a gouty acidity, such as is called the lithic acid diathesis, and which is shown by excess of urea and highly acid urine, with deposits as the latter cools,—if there is flatulency and heartburn, and general gastric uneasiness,—potass salts may remove present cause, but nitrogenous food must be discontinued to a large extent, and more water taken, so that the diathesis may be changed. The ordinary water consumed should have a minute quantity of mineral saline in its constitution, so as to encourage a looseness of the bowels. If the tendency is to the rheumatic or lactic acid condition, a similar course must be followed, together with a temporary abstinence from those conditions which lead to a lactic acid formation. These are especially promoted by malt liquors and excess of vegetable food. The constipation, which so often accompanies dyspepsia, must be got rid of by a proper regulation of diet, and not by taking aperient medicines. If the latter course is followed it is sure in the long run to produce a very serious evil. Those derangements which in the first instance are only functional will become organic, and the difficulty of cure will then be multiplied a hundredfold. The human system is very like a steam-engine with a thousand tubes in its structure. If an impure water is used some tubes are soon blocked up in the engine by the *débris ;* and so are the different emunctories of the body, when too much or a wrong kind of food is taken. Some carbonaceous material is kept back, and the system is fouled. Sedentary occupations, such as teaching, tend very much to this kind of fouling. A man sitting in his chair for an hour gets rid of so many cubic inches of CO_2, according to the capacity of his lungs. The inspired air will contain four parts of CO_2 in 10,000, but the expired

Rheumatic diathesis.

Sedentary habits and excess of food lead to deposit of fat.

air should contain from 2 to 4 per cent. If the man walks a mile, the quantity of CO_2 which is passed out of the body is doubled; if he walks two miles in the same time, it is increased threefold; if he walks five miles, it is increased sixfold, hence the purifying and warming effect of exercise. If a man takes much carbo-hydrate into his stomach, he must take exercise to free himself from its *débris;* and if he does not, he gets fatty liver or some other fatty state which destroys his health and happiness. If he eats more food than the juices of the stomach can act upon, the undigested matter passes down, and undergoes unhealthy changes in the stomach, which an aperient may carry away for that time; but if he repeats the offence he is soon in the same condition again, and the same dose of aperient will either fail in its effect or irritate the mucous membrane of the stomach, and so still further damage the organ. Abstinence from food in such a case, and then a change in its quality, will be much more efficacious than physic.

Indigestion is not to be cured by whip and spur; the use of alcohol, mustard, peppers and gingers, and such-like aids to digestion are in the wrong direction, —they may relieve a present state of flatulency caused by painful fermentation, but they do not remove the cause, and if persevered with, because they give present relief, they will tend to promote a thickened state of muscular tissue in the stomach itself, and perhaps bring on incurable disease.

Aperient physic not to be frequently indulged in.

If there is a very loaded state of the stomach, as indicated by foul tongue, perhaps headache, loss of appetite, and a feeling of distension, especially if it has been caused by an overdose of food, an emetic of ipecacuanha may give immediate relief; but one cannot do like the old Romans, take emetics every day so as to enjoy the pleasure of eating again; but such a course would be much safer than flying to a blue pill and black draught, which is a favourite remedy with those who wish to remove the present distress without going to the fountain-head, and getting at the cause of the evil itself. Equal parts of blue pill and compound rhubarb pill in ten grain doses, taken at bedtime, may be advantageous in some abdominal disturbances in which it is necessary to take away a present load; but to go on taking such doses will only end in a breakdown of digestive power altogether, or the earlier production of hæmorrhoids, or piles, as they are commonly called, and so lay the foundation for much discomfort and suffering.

Those who inherit a strong lithic acid or gouty tendency may take a daily dose of some mineral saline aperient, such as Carlsbad or Cheltenham salts, in a tumbler of warm water early in the morning, especially if they are inclined to obesity; whilst they who are filled with flatus, and have acid eructation, will do best with a charcoal biscuit or two, and the avoidance of flatulent vegetables, pastry, and broths.

Antibilious.

Indigestion may arise from deficiency of bile as well as excess; for those conditions it is the custom to take mercurials. It is evident that a bilious condition cannot be an antibilious state, and yet both conditions are often treated alike. It is not good practice to whip a liver which is already loaded with too much bile. It is much more sensible to cut off the supply of nitrogenous food; whilst if there is a defect of bile, exercise will bring out a condition allowing of the digestion of those matters which tend to bring the bile acids into activity, and get them excreted into the alimentary canal. Spare and emaciated dyspeptics, who cannot digest fat, should set themselves to overcome this evil. They cannot cure their dyspeptic state by avoiding all things which apparently disagree with them. They must clear their emunctories of the *débris* which oppresses them. They must see that the air they breathe is free from excess of CO_2, so that the air they draw into their lungs is not already provided with the excretion which it is called upon to remove, and they must also take care that the skin is in a state to assist in the proper purification of the body. The balance of order in the secretion of the digestive juices has been disturbed. This balance must be brought back again by a purifying process before the saliva takes on an alkaline reaction, the gastric juice has its complement of acid, and the secretion of the pancreas and mucous glands the alkalies which are wanted for healthy digestion.

Pure air necessary.

CHAPTER XIII.

EXERCISE.

Natural instincts must be followed.

I HAVE pointed out the character of the food which nature requires, and have given some general instructions as to the necessities of healthy digestion. We will now look at the subject from another point of view. See how keenly those children enter into the excitement of their games, in the field or playground. See how restless those little ones are in the schoolroom,—how impossible it seems to be to keep them still; how difficult it is to fix their attention upon the single subject which the teacher is wishful to inculcate; how little the teacher is fit for his duty when he scolds them for inattention, and punishes them for wandering from the subject before them. The right principle for the teacher to follow is to seize hold of the natural instincts of the child; not to threaten it, but to use the restlessness itself as a means whereby education should be forthcoming. A child's constitution is a thing which cannot be kept (like a bow) bent for long in one direction without injuring it. Nature dictates to us that muscle must be continuously exercised if it is to be well developed; that muscles which are not continuously used whilst the child is awake are not properly developed, and lose some of their natural power; that children must have their

Exercise necessary for muscular development.

muscles tired out if they are to be kept quiet. I ask teachers to refer to the anecdote mentioned in page 129 (where Physical Exercises are considered), and if they will study the indications which that anecdote affords, they will better understand how restlessness and inattention must be dealt with, if they wish to preserve order and regularity in the school hours, as well as in the dormitory. If we experiment upon two brothers equally strong or equally weak in a similar manner as regards everything else except the work to which each is put, we may gather much information. The one sits upon a stool all day, doing some trivial work with his fingers, whilst the other is instructed in the mysteries of the blacksmith's anvil. At the end of a twelvemonth there will be a marked difference between the muscular developments of the two. The arm of the one will be many inches more in circumference than the other. The biceps of the blacksmith will feel hard and tense, that of the other soft and flabby. Regular and steady work has led to a great increase in the power and size of the muscle, has developed new cell-growth in its tissue, and has cleared away the cell-fibres which have been used up in bringing out muscular power. Besides increased development, continuous work in the end produces healthy fatigue. A muscle, however, cannot be kept in use too long without mischief resulting, such as is shown by the diseases called *writer's cramp* or *scrivener's palsy* (see p. 122). There must be time for rest; during that rest repair takes place, and *débris* is taken away from the muscle tissue by the absorbents. The natural fatigue which results from wielding the sledge-hammer produces sleep which is sweet and refreshing, and at the same time sets up a demand for food, which makes a blacksmith's appetite something positive. To wield the hammer as a blacksmith does, brings into play a series of muscles, all of which partake of the feeling of fatigue, and lead to the urgent necessity for rest, and at the same time to a demand for nutrition. The mischief which results from harping upon one string, and working a single muscle for too long a period, as in writing incessantly, is often serious: the repair is interfered with, some *débris* remains behind, and the nerve which is distributed to the overused muscle is irritated by the refuse matter, and a painful spasm results, or a loss of power follows, leading in the end, it may be, to actual palsy. Muscles must be also equally exercised, otherwise there may be mischief. If a limb is damaged by the division of its nerves, in consequence of which the power of muscular movement is lost, the muscles at the time of injury being in a perfectly healthy state; they soon lose their tone, become more and more flaccid, and in course of time are changed into a series of fat granules, which become deposited in the muscle cells in the place of healthy muscular fibre. There are changes taking place in a muscle which will in time alter its character, and take away its contractile power. If its function is not regularly performed, the old muscle cell elements decay, and if their skeletons are not removed as they ought to be, they soon enclose minute grains of fat in place of muscle cell; no new muscle tissue is formed, the *débris* continues *in situ*, and the call for nitrogenous matter, to repair the waste of tissue, does not arise, and there is a loss of appetite as well as loss of power. If muscle is not used, or if more food is taken than is required for its repair, there is a development of more or less fat in all the organs of the body, not only in the muscle cell, but in

Muscular palsy from over use.

layers around the organs. Instinct generally leads the child to make muscular movement, and hence the intensely restless character of the majority of children. If they are quiet for any length of time, either from thinking too intensely, or being heavy and listless, there is a retention within the system of used-up matter, which is ready at hand to produce illness or allow of the easy introduction of infectious disease, should the germs capable of setting up that class come into contact with the mucous membrane of the individual in question. Those who are not properly exercised are more prone to take on infectious maladies than those who are always in the open air, exercising their muscles, and getting rid of used-up material as fast as it is formed.

Want of exercise increases tendency to infectious disease.

The principles thus inculcated should guide the teacher as to the means whereby he will be able to keep himself in health as well as the class which is under his care. Without muscular exercise he cannot keep himself in health, and without exercise he cannot bring out the muscular sense (properly so called) in his scholars. This sense, sometimes called the sixth sense, is necessary for the proper guidance of muscular movement. There is, to some extent, an association of this sense with that of sight, but its own perfection is brought about by exercise, and it is to its manifestation that the delicacy of touch is rendered serviceable, and the great masters in athletic sports, at the rifle-butts, and in the use of stringed instruments, etc., are made. This muscular sense is probably presided over by a particular part of the brain, but just as the blacksmith's biceps develop by active use, so the seat of instinctive muscular finesse is increased in power by its continuous activity at regular intervals. Character is sometimes read by

The muscular sense.

the aid of the copybook; the form of the letters will guide the expert as to the nature of the writer's brain-power, and enable him to conclude that there is unequal development, and therefore a chance that its balance may be interfered with. It tells us that there is inequality. It is the duty of the teacher to counteract this tendency, and to see that each organ is exercised in rotation, and that one part of the brain, or one part of the muscular system, shall not be developed at the expense of the other, but that the principle divisions are brought out in order. If the muscular sense is lost, the proper action of the muscle can be no longer regulated; if it is not used, the feeling of fatigue which is necessary for healthy slumber is not forthcoming. Our notions of space and distance are dependent upon its proper exercise, and even the ordinary work of doing nothing involves the use of this sense. To some extent Nature has not left us entirely to our own free-will in the matter, but those parts of our nature which are brought out by vegetative life are very small compared with those for which a free-will is required—a free-will on the part of the individual, or of some person to whom the individual is willing to render the service of obedience. It is necessary to fatigue the muscles to a moderate extent for several reasons.

Fatigue of muscle necessary for health.

(1) Exercise produces a greater freedom of circulation, by means of which the blood is hastened in its current through the system, and exposed more frequently to the vivifying action of the atmosphere in its passage through the lungs.

(2) It produces a greater demand for carbon compounds, and thus promotes a healthy appetite.

(3) It increases the equality of the animal heat by promoting the combination of carbon with the oxygen,

by means of which carbonic acid is formed in the blood, and the temperature kept at its normal standard.

(4) It increases the evaporation of liquid from the skin and lungs, by means of which there is increased desire for water. The water taken into the system dissolves the salts which have been formed in the process of renovation of tissue, and which should be carried away to the various emunctories and expelled from the system.

Also for healthy sleep.

(5) It promotes a desire for rest and sleep, and enables the absorbents to be at work in the renovation of nerve matter—an operation which cannot go on in its proper manner whilst the brain is awake. Sleep is therefore necessary for brain repair, and sleep to be of the proper kind must be preceded by muscular fatigue.

Narcotics hurtful.

There is a sleep which is caused by over-fulness; it is brought on by indulgence in the pleasures of the table, besides another kind which is promoted by narcotics. That sleep is a delusion and a snare. It may allow the muscles to rest, but it does not allow the brain to be freed from its refuse matter; it is followed either by dulness or headache. Any teacher who flies to narcotics or stimulants for the purpose of obtaining sleep is knocking a nail into his coffin, and hastening the end, instead of travelling on a road which leads to health.

Intemperance in exercise.

Excessive muscular strain, especially that which arises from the strain being kept up on one muscle or one set of muscles, is to be deprecated. Those who have danced all night, when they have been unaccustomed to that kind of exercise, are like Goldsmith's pair, that 'simply sought renown, by holding out to tire each other down,' and paid for it the next day by frequent attacks of cramp in the muscles of the calf of the legs, which conclusively proved that they had overtaxed their strength, and had damaged their muscle by interfering with its recuperative powers. Every kind of exercise, if it is to be beneficial, must be regular, not carried out by fits and starts. A man who walks twenty miles on a Sunday, and only one each other day of the week, is intemperate, and suffers in consequence: just as a man who drinks a bottle of wine on one day of the week, and only a glass on each of the other six. He will probably be a drunkard; whilst he who takes double the quantity of wine in the same time, or has divided it equally for each day of the week, is looked upon as a jolly good fellow, and does not come to harm from its use in anything like the same length of time as the other. Training for the development of muscular power, and for the perfection of the muscular sense, must not, therefore, be carried on for an excessive length of time; it must be regular, day by day: spurts are to be especially avoided, as liable to bring on conditions which tend to weakness rather than the contrary. They are often the foundation of disease which develops some time afterwards, especially that affection of the blood-vessels which is called aneurism, in which a vessel, being inordinately strained, gives way in its inner coat to the slightest possible extent, and—like a roof of a house in which a tile is loosened, each successive tempest increases the damage until the house becomes uninhabitable—the vessel gives way, and death immediately results.

Sleep: when to be obtained.

Sleep.—'Blessed is he who first invented sleep,' a saying of Don Quixote, paraphrased by 'Lord Dundreary,' as if it was something new. 'Tired nature's sweet restorer,' how often has it been courted by the teacher, and how it has fled from his embrace! First and foremost in the struggle for sleep is the necessity that exists for regularity in trying to obtain it. Habit is a very important factor in its production. It is quite immaterial as to the time at which it is obtained, provided it is encouraged at one particular hour. No doubt the natural time for healthy sleep is soon after sundown and before sunrise, but civilization is opposed to nature, and all our gregarious arrangements tend to throw its acquisition nearer to the time of sunrise than sunset; but no sleep will be so satisfactory which is not sought for at one particular hour in the twenty-four. I urge, therefore, that a man should contrive to go to bed as near to the same hour as possible, whether he is sleepy or not. It is not wise to encourage sleep when the stomach is full, unless the strictest rule has been followed as to quality and quantity, and also that the fatigue is that which exercise has produced. In that case we may imitate the animals, and go to sleep whilst digestion proceeds, especially if the teeth are perfectly sound, and mastication of food has been duly performed. Those who have not good grinders will be wise to walk a little after the last meal, before retiring to rest; and never go to bed with cold feet. Cold feet mean more blood at the other end of the body than is consistent with healthy sleep. Fresh air is also necessary, the purification of the blood goes on during sleep as well as during wakefulness; the discharge of carbonic acid is not so continuous as during the waking time, and the presence of impurity in the bedroom, by diminishing purifying action, still more promotes a condition which leads to wakefulness.

Repair of brain power goes on during sleep.

The repair of the brain can only go on during sleep. The rest which allows of repair in the heart is obtained between each beat; but the rest to the brain is only established when the mind and thought are completely dormant. There is an old proverb which has some truth for its basis, viz. that as to the necessity for sleep, it is six hours for a man, seven for a woman, and eight for a fool. The young child requires more sleep than an adult, and will be all the better for ten or twelve hours; which seems to indicate that more time is required for the growth of brain-matter than for its renovation.

Time required.

Must be regular.

Sleep is as much a necessity of life as food; it must be indulged in, for there is a production of material during wakefulness which kills, if time is not allowed for its removal. This can only take place during sleep; and hence the necessity for a regular habit. An average duration of six hours in a solid block is sufficient sleep for the active mind, but probably when conjoined with real muscular fatigue, a longer period is required. There are many plans adopted by the sleepless to induce sleep: a mother soothes her child by a simple ditty; a listener to some monotonous drone is likewise lulled to sleep; soft music entices the eyelids to close in slumber; and to some persons a perfect stillness, so far from provoking sleep, leads to wakefulness. It is not at all an unusual thing for an invalid to be read to sleep, but the monotony of sound must be aimless and profitless if it be successful. Muscular exercises, pure air, and a moderate amount of food at regular intervals, with an honest and unsuspicious mind, will be the best sedatives that any one can take: we must avoid narcotics, as we ought to avoid all poisons, if we wish to be healthy, and then that common accompaniment of sleeplessness, to which brain-workers are especially liable, viz. headache, will not arise.

CHAPTER XIV.

HEADACHES.

Headache : Four causes.

HEADACHE : its causes are fourfold.

(1) Fulness of habit (plethora or hyperæmia).

(2) Defective supply of blood or excessive loss (anæmia).

(3) Impure quality of blood.

(4) Presence of morbid effusions or some structural change, the consequence of either of the preceding.

Plethora, or fulness.

Headache from *Fulness of blood*, or *Plethora.*—This condition may arise from luxury, muscular idleness, or from an excessive quantity of food, from ligatures, as tight stays, collars, or other articles of dress, or from the non-removal of excreta, by which a pressure on the veins of the body is brought about, and a greater quantity of blood is thrown into the cerebral sinuses than they can bear with impunity. The remedies are continuous exercise, abstinence from stimulating food, and water only for drinking purposes, avoiding all those nitrogenous foods which tend to produce too much flesh.

Anæmia, or poverty of blood.

Anæmic Headaches.—This class is a common one among teachers ; often produced by too long hours of study in a foul atmosphere, or by losses of blood, from piles, etc., excessive use of aperient medicine, sexual excesses, and improper diet. These are the first causes in most instances. Whatever tends to interfere with the regular circulation, and produces local congestions, will promote the conditions which give rise to anæmic headache. The excitements consequent upon the success or failure of the children to come up to the standard in the examination; anxiety about private affairs; undertaking too much work, so as to deprive the teacher of the time required to masticate his food properly and obtain the necessary supply of sleep,—all these tend to produce poverty of blood, or to lead to hæmorrhages which the teacher cannot bear. This applies especially to women at certain times.

It is impossible to cure these kinds of headache until the cause is removed. Without that as a first step, quinine, and iron, and similar tonics, which under other circumstances may be extremely beneficial, are simply worse than useless.

The true principle of cure is to equalize the circulation; especially by promoting the progress of the blood through the feet, so that the latter may not be cold. If they are so, immediate measures should be taken to warm them. If the forehead is cold when the headache is severe, a cup of hot tea will be serviceable if the skin is dry; if it is moist, coffee will be better. If the head is hot and the feet cold, the irregularity must be overcome and the temperature equalized before it is possible to remove the headache.

Rest necessary.

To attempt mental work whilst such a headache lasts increases the mischief, for it is adding to a *débris* which is already excessive. Neuralgic headache—brow ague, as it is sometimes called—is associated with this class, though it is more frequently connected with errors of diet and stomach derangements, or with miasms, which have altered the quality of the blood.

This is especially so with the class which is called *megrims*. Alcoholic drinks increase the tendency to this class of disorder without the least possibility of curing them. They give relief to the acute pain in consequence of the same conditions being set up which render a drunken man insensible to the effects of an injury, but as soon as the narcotic effect of the stimulant has passed away, the pain becomes still more severe. We may depend upon it that there are true physiological reasons why alcoholic stimulants cannot cure headaches. I would especially warn women to the danger they run when they fly to such remedies for the distressing pain which they have sometimes of endure. Have patience with it, get the circulation established equally all over the body by outside warmth, by friction, by hot unstimulating drinks; be careful as to the food taken, and get all the pure air to breathe that can be got; the pain will subside in time, and not be increased on the next onset, as it will be if dangerous remedies are taken.

Headache from impure blood or miasms.

Headaches from impure blood are those which arise at the beginning of fevers and other acute diseases—they are produced by blood-poisons, as they are sometimes called; they necessarily bring a stop to the teacher's work. There is a class which are caused by miasms, such as the marsh miasm and other agents at present unknown, which bring about brow ague, megrims, and neuralgia of various kinds, in which there is no intermission of fever, and the teacher is able to do some of his duties during the time he is suffering. A damp basement, with the emanations arising from the bodies of children in a crowded, ill-ventilated schoolroom, especially if their clothes have been wetted by a sudden shower of rain at the time of assembly, will frequently produce this class of headache in an anæmic teacher. There is no remedy for this, unless the cause is removed, which, if done, will be rapidly followed by relief, and no medicine will then be really required. The teacher who is subject to headache should not rest until its cause is unravelled. Perhaps it is due to a lithic acid diathesis, or a gouty state of blood; an examination of the urinary secretion will assist to prove this. If that secretion be high-coloured, if it throws down a deposit of red grains, looking like sand, or an ochreous cloud, especially if the tongue is foul, there is probably gout, and certainly indigestion. The quantity of food must be limited; the quality changed to a milk diet, with but little nitrogenous or meat food, and no stimulants. Perhaps the condition may be connected with the lactic acid or rheumatic temperament, in which case the skin must be especially cared for, and those foods which are liable to take on the lactic fermentation, such as pastry and malt liquors, should be carefully avoided. The intestinal canal must be cleared if any offending matters are present, and although it is nasty, there is no remedy equal to a dose of Gregory's powder in the morning (especially if there be a sour taste in the mouth), or a dessert-spoonful of castor oil at bedtime. If the urine be loaded with lithates, it may be right to take an alkaline water, such as lithia-water or potass-water, in a fair quantity every day until the evidence of defective washing is removed. When there is obstinate constipations, the habit of trying to persuade the lower bowel to empty itself at a particular hour every day must be formed, and all irritating purgatives put aside. Purgatives are like alcoholic stimulants: they are absolutely necessary sometimes as helps to get over a present difficulty, but if that difficulty is a daily recurring one, there is a fault somewhere which

Treatment.

Purgatives must only be temporarily used.

should be removed, and then the necessity for a purgative will pass away. Indeed, the daily use of purges, by preventing the bowels from having a natural relief, is itself keeping up the constipation. The bowels get like to a donkey which won't go until it is beaten, because it has been so accustomed to wait for the stroke, that it does not understand any other order. Bowels, like donkeys, may be made to go without the whip if their owners have but a few grains of *common-sense* in their constitution.

Sick headache.

Sick headaches, sometimes called bilious, are connected with digestion and its derangements ; they may be induced by fatigue or excitement, or be the result of last night's debauch, or the sequence of a heavy supper, or of any other meal which is in excess of the requirements of the system. They are indicative of structural change somewhere, and the victim is on the high-road to the establishment of organic disease, either in the liver, as fatty liver, or some inflammatory condition, which will ultimately lead to wasting of the organ, or to some brain or kidney mischief. I can only repeat, go to the cause, and remove it unhesitatingly, if you want to recover your health. To trust to medicine, and continue to endure the cause, because you like it, is not a course which a teacher should follow. The liver is often blamed for producing a set of symptoms, because it is a link in the chain, but it is only one link of several others.

Nervous headaches.

Nervous headaches are sometimes the sequence of anæmia simply, such as those which arise after the immediate and excessive loss of blood. These may generally be relieved by a proper course of steel ; others are connected with a commencing degeneration in the membrane lining the delicate vessels which supply the brain tissue, and which degeneration is called atheroma (or fatty degeneration). The minute vessels have lost their elasticity, and cannot dilate and contract as they ought to do with every pulsation of the heart. The result of this loss of tension is that either the supply of blood to the brain-cells is defective, or there is a loitering on the way of the blood corpuscles, which is not consistent with the work they have to perform, and, as a consequence, the products of brain-cell work are not all dissolved and carried away by the veins as they ought to be. There is severe pain in some part of the head. There is often great intolerance of light and sound. There is a frowning appearance, and an irritability of temper which is out of place in the teacher. When these symptoms arise a long rest from brain work is absolutely necessary, with exercise of a continuous and regular kind in the open air, and a course of diet which shall tend to diminish the presence of fatty matter in the blood, and remove that foggy state which has arisen from its want of proper purification.

Congestive headaches.

Congestive Headaches are often connected with disease of the heart, tending rather to dulness and inactivity than to restlessness and irritability, though the latter may be present if the brain tissue is damaged. These cases are liable to end with apoplexy from a ruptured vessel in the tissue of the brain itself. When these headaches arise, the duty of the teacher ought to be suspended, and he should retire from office for some time, for it is quite impossible to remove the cause whilst school duties are attended to.

There are numerous sources of headache besides those to which attention has been directed, but there is scarcely one which may not be brought into alliance more or less with the conditions which have been referred to, those which result from direct violence excepted ; but it is, of course, quite impossible in the space at my disposal to do more than give general directions as to treatment. The whole may be summed up in the instructions conveyed in the rule, that the cause must be found out, and being abated, the treatment must be in accordance with common-sense, if it is to be effective, and all empirical plans and treatment by guesswork are more likely to be injurious than beneficial.

CHAPTER XV.

THE EYES.

A VOLUME might be devoted to this subject; nay, a dozen volumes would not exhaust all that might be written upon the management of the eyes, and the mischiefs to which they are exposed by improper use. I propose to restrict myself to the injuries and diseases which affect them more particularly in connection with daily school-life, and which often do not require the aid of the ophthalmic surgeon to remove if they are treated early, with common-sense. Optical defects may of course arise in children as well as in teachers. The circumstances which often bring them about, and which the teacher's want of knowledge as to the first causes assist to make worse, are those which are closely connected with the customs of school-life; they are those which I shall more especially deal with, but I shall also refer to diseases which are common among children. I shall conclude this chapter with practical suggestions for the care of the eyesight.

Foreign bodies in the eye.

Injuries.—The most common injury, showing itself by sudden and acute pain, is often produced by particles of steel or iron from the flange of a locomotive or other sources, upon a railway or high road, or by a portion of slag or coal from the furnace of the engine, or a piece of grit from a dusty road, sticking into the cornea. Impinging in the first instance upon the ball of the eye, it is immediately wiped away by the eyelid and sticks into the conjunctiva, which is the name of the mucous membrane covering the eyeball and the eyelids. There is generally acute pain, the lids close convulsively, and efforts to remove the offending cause only tend to increase the irritation and spasmodic closure of the lids; perhaps the grit or iron spike may stick into the membrane which lines the cornea. It then only causes pain when the lid is shut, as when winking. If the foreign body is embraced by the lower lid there is no difficulty in removing it. The corner of the pocket-handkerchief will wipe it out if the lid be everted. It is often found to be a small insect whose sting is transient in its effects. When the particle is beneath the upper lid the process is not so easy: the lid must be raised and turned upwards. It may be done by means of a bodkin or fine knitting-needle, the bodkin being placed above the lashes and pressed backwards against the ball of the eye, and then by means of the lashes the lid should be turned upwards upon the bodkin and its mucous membrane exposed. The foreign body will be seen in the centre of a patch of congested vessels which are in the membrane; that is, if there has been time enough for the onset of the inflammation which soon follows upon the intrusion of the foreign body. It is sometimes difficult to extract, but it may generally be wiped away by the border of a silk handkerchief or a fine piece of wash-leather. If the particle sticks into the cornea it is much more difficult to extract. It is not always easy to discover it, especially when it is a minute particle of bright steel or a fine flake of flint. Miners and other workmen engaged in ironworks are especially liable to

Must be removed.

this accident. They have a very safe method of removing the offending body. The miner sits down upon the ground, his mate kneels beside him, and, everting the eyelid, licks the cornea with his tongue, and thus scrapes out the offender without risking any injury to the eye. The surgeon picks out the object with the point of his lancet. The unskilled assistant had better not use a sharp instrument, but scrape it out by means of the eye of a needle, sticking the point of the needle into a large cork, and holding it firmly by that means. If the needle has been magnetized, and the offending object is a particle of steel, it may be more easily extracted; but the magnet is only likely to be useful in very rare instances, though the plan is sometimes put forward as a very neat use for that instrument. The foreign body being removed, it is only necessary to bathe the eye first with warm, and afterwards with cold water: all other applications are best let alone. The cause being removed, the effect will cease. If, however, the cause has been in operation for several days it may set up violent conjunctival inflammation, which expels the foreign body by means of the discharges which are produced, and then the inflammation itself becomes the more important disease: it generally goes by the name of ophthalmia.

Ophthalmia.

Ophthalmia is very often produced by the impaction of, or as the result of, foreign bodies. It may be produced by any injury to the eye, as a cut from the thong of a whip, or a sudden swish from a twig in getting through a hedge, as when boys are surprised in the unholy occupation of birds'-nesting or orchard-robbing. These injuries are best treated by the application of cold water. If the inflammation is superficial it will soon subside. If there is severe pain in the temples, and inability to bear the light, the mischief is deeper seated, and the patient will have to submit to a more rigorous treatment, which will require him to be kept in a room from which direct light is excluded by a green blind or some other means, so, however, that air shall not be kept out of the room. Much mischief is often done to the constitution by keeping the patient in a darkened room which is badly ventilated, and from which air as well as light is excluded. The teacher should look to this, and not allow a temporary mischief to be a means whereby a permanent injury may be done to the constitution. If there is supra-orbital pain and intolerance of light, skilled aid should be sought for.

Treatment.

Pustular ophthalmia is a painful form of disease, but if treated properly it may be cured without any evil result following; but if it be neglected the sight may be irretrievably injured. Pustules or pimples arise in the mucous membrane on the eyeball. If the ulcer which follows upon the pustule eats into the harder tissues, there may be acute pain. The condition is one which often attends upon teething in young children, and sometimes whilst the second eye-teeth, or 'canines,' as they are generally called, are being perfected.

Pustular ophthalmia.

These teeth are developed between the ages of nine and twelve years of age. It is difficult to heal the ulcers until the teeth have cleared the gums. The general health must be especially attended to. The little circular ulcers which exist in the mucous membrane may be rendered less sensitive by filling them with a small quantity of calomel. Children having these pustules upon the eyes should not be kept at study, but encouraged to spend as much time as possible out of doors, whilst such tonics as steel, cod-liver oil, and hedozone may be safely administered.

Steel dietetics indicated.

Hedozone is an excellent diet-drink for such cases; it is far more advantageous than any form of wine or other alcoholic stimulant, whilst children like it. It is more easy of digestion than most forms of medicine in which steel enters as a part of their composition. Indeed, all cases in which steel is indicated, or a strengthening tonic is required, will be especially benefited by hedozone. I find it a much more digestible article than zoedone, besides being the first diet-drink of the kind which was manufactured. Those who are benefited by steel, who have pale faces, who want blood-tonics, who suffer from anæmic headaches, or who may require their arterial system to have its tension increased, will always find benefit from the use of hedozone, taking it either with their meals or as a draught of tonic waters at any time when most convenient. It is far more satisfactory than any kind of wine or malt liquor can be, and provided the bowels are not allowed to become confined, it will be certain to be beneficial, whilst it cannot damage the cell-tissue and the minute capillaries as alcoholic liquors may do. At the same time it is advantageous to have exercise in the open air, and to use fruit and vegetables freely. I never advise the use of caustics or of lead lotions. They increase the chance of scars upon the cornea, and may assist to damage it irretrievably. If care is taken to treat these ulcers properly, they do not lead to disfigurement.

Purulent ophthalmia.

Purulent ophthalmia, as mentioned in the first chapter of 'School Surgery,' is a very serious disease. It must not be confounded with *catarrhal ophthalmia*: both are infectious, and both are at times epidemic. The latter is common among children, leading to what are called weak eyes if the child is made to use the organs when the conjunctiva is inflamed.

Granular lids.

The epidemic form is sometimes kept up by the irritating effect of some kinds of pollen grains in some districts, causing a so-called hay-fever. An apparently similar state is sometimes produced in schools in which arsenic paper has been used upon the walls of the classrooms. Either of these will give rise to the state in which the conjunctiva becomes 'granular.' The cause must be removed before the effect will cease.

The *purulent form* is a very serious one. It is very infectious, probably propagated by some micrococcus whose especial nidus is the conjunctival membrane. It can only be eradicated by the most persistent cleanliness and the continuous application of disinfectants and germicides, so that the germs which set up the purulent discharge may be completely destroyed. It is met with in great charity-schools, in which personal cleanliness has been neglected, and filth allowed to accumulate in the corners of the dormitories or elsewhere. It is one of the most frequent causes of blindness. Whenever a teacher finds a number of children in his school the subject of ophthalmia in any of its forms, I strongly advise him to get the aid of the medical officer of health, so that skilled assistance may be at once obtained to arrest the spread of the disease.

Opacity of cornea.

Opacities of the cornea, which are dull-looking spots upon the clear part of the eye, often follow upon these forms of inflammation. They cannot be remedied, and are better let alone. The accidental or designed introduction of quicklime and other acrid matters into the eye may lead to a serious form of inflammation, which may cause total loss of sight, or leave opacity of the cornea behind it, which sadly interferes with the function of the organ. This accident should be promptly met by the use of water, slightly acidulated with vinegar, and the application of sweet oil. If the irritant is a corrosive acid the wash should be water only, and pure oil should be then applied as quickly as possible. As soon as the irritating or corrosive matter is removed, and the part well oiled so that the lids cannot adhere together, the eye should be covered up with some carbolized lint or non-putrefactive material, and the patient kept in a dimly lighted room. If the pain subsides in a little time, no great harm will be done. If the resulting inflammation is deep, there may be serious, if not dangerous mischief to the eye, which will require active treatment to subdue it.

Iritis.

Iritis is not uncommon; if neglected it frequently leads to serious injury, and even loss of sight. The iris is the curtain of the eyeball which contracts or dilates the so-called pupil, and regulates the admission of light to the retina. The retina is the nervous coat which receives the image of the object looked at, and is on the posterior wall of the organ. If the tension of the curtain is interfered with by inflammation, and its muscular contractibility impeded, there is an absence of or an irregularity of contraction or dilation. The circular outline of the pupil is lost, and its colour is changed. It is a serious disease. There is intolerance of light, supra-orbital pain (that is, pain in the temple), which is very troublesome at night, especially in the rheumatic form of the disease. It may be present without much interference with the general health, so that teachers have been known to carry on their duties whilst suffering from iritis until the sight is quite lost by adhesion of the curtain to its neighbouring parts. The disease may arise from direct injury, such as by a blow; it may be the sequence of catarrhal or other forms of ophthalmia, or it may be syphilitic, rheumatic, or gouty in its origin. Each form will require different treatment, which the skilled surgeon can alone direct. It is curable if treated in time, but its cure is inconsistent with work. So that the subject of it must perforce give up the use of his eyes until the tension of the curtain is restored.

Cataract.

Cataract is caused by a change in the crystalline lens. The lens is placed behind the pupil; it is in shape something like to an acidulated drop, convex on both sides, and should be perfectly invisible. It changes its position nearer to or farther from the curtain of the pupil, according to the requirements of distance. By its means the light is focussed correctly. The pupil loses its natural blackness as the disease arises, and the lens becomes visible generally as a whitish-brown film behind the curtain. It can only be cured by the ophthalmic surgeon.

Glaucoma or amaurosis.

Glaucoma is a disease in which there is an interference with the secreting and absorbing powers of the apparatus of the eyeball, leading to its further deterioration. Its progress is sometimes checked by an operation which is called iridectomy; but if it has led to change in the tissue of the nerve coat of the eye the case is hopeless.

Amaurosis is of this character, when the nerve is paralyzed or otherwise damaged by varicose states of the vascular coat. When absolute it is hopeless; but there is a temporary form produced by excessive smoking and other vicious habits, or in females by over lactation, which is curable if the cause can be discovered soon enough, and at once removed.

Muscæ volitantes.

Muscæ volitantes, floating specks and vague images, taking the form of threads or spiders' webs, or even insects, are sometimes considered to be evidences of commencing amaurosis. They appear on the field of vision and fade away, or dance about to the terror of the victim. They are generally due to gastric or bilious disturbances, or to diseases of the vascular system. They may be cured by attention to the general health, and by the removal of the causes which are leading up to the mischief. They often cause great fear in the mind of the teacher. At times the fear is well founded, but much more generally they indicate temporary disturbance and errors of conduct or diet, which, if the warning be taken, will soon lead to the removal of the trouble, provided the cause is discovered and avoided in the future. They should not be neglected.

The troublesome affection to which the term *Stye* is applied has been dealt with in 'School Surgery,' in connection with the subject of skin diseases (*vide* page 214).

Occasionally the glands called meibomian, which are placed in a row at the edges of the lids and at the roots of the eyelashes, appear to take on a chronic inflammatory state, and cause the condition to which the term 'blear-eyed' is applied in some districts. It is often commenced by a succession of styes, which are minute abscesses in the glands, and which have been irritated by improper applications; or it has been caused by a continuous residence in an atmosphere loaded with irritating particles; but the causes being removed and the general health attended to, in most instances the effect will cease.

Want of co-ordinating power in muscles of the eyes a cause of disturbance in sight.

It must not be forgotten that varieties of disturbances of sight arise in connection with general health, and that it does not necessarily follow that the sight itself is in danger of being lost, because of the want of power to accommodate the eye to the different positions in which the body is placed as regards the object looked at. A difference in the focussing power of the two eyes is not uncommon, just as there is more power at one time than at another in different sets of muscles, as we find when the back and the spinal column becomes twisted and contorted to one side or the other from habit; so one or other of the six muscles which act upon the eyeball, or one of those which act upon the eyelids, may become the subject of sudden spasms, or they may lose some of their power and be partially or completely paralysed. The differences in focussing power lead to alteration of sight in one or both eyes: one eye may be long-sighted, the other short-sighted; or there may be an irregular action produced upon the ball, by which the position of the lens is altered, and correct vision interfered with. The structure of the eye has been imitated by man in the formation of the telescope and microscope, and a knowledge of the structure of these instruments may assist in making us understand the structure of the eye. The focussing power is in the muscular apparatus and the fluids of the eyeball, which are pressed upon by the muscles. The change in the length of the ray of light is regulated by the muscles. Irregular action in those muscles, by interfering with perfection of adaptation, destroys for the time being the efficiency of the organ, just as an opera-glass is put out of gear by unequal object glasses.

A paralysis of one or more muscles sometimes

Causes of want of equal power in muscles.

follows upon *diphtheria* or some other blood malady. Such conditions are removeable by healthy change and a properly arranged plan of treatment. The paralysis may be the *avant courier* which ushers in apoplexy. There is a *squint* or double vision, which is caused by rupture of a small vessel in the centre of the base of the brain. The minute vessel continues to bleed into the tissue of the brain, until a pressure is exerted on an increased area, and the patient lapses into unconsciousness and dies. A squint may be due to some external irritation, as teething, or to a gastric disturbance. This form is common among young children, and when observed should be treated on scientific principles instead of being altogether neglected (as is but too often the case), until convulsions arise. When the external muscles which regulate the position of the eyeball are out of harmony, the images which fall on the retina (the sensitive membrane of the eye) do not correspond: there is double vision, and to avoid the discomfort of that effect children learn to squint so that the image upon the retina of the eye which has the weaker muscle is suppressed; ultimately the vision in the squinting eye is much impaired. The constant strain increases short sight, though occasionally the opposite condition arises; the former holds when the squint is internal, that is, when the muscles which move the eye converge towards the median line. It gradually arises when small objects are held closer and closer to the face.

Differs from old sight.

The weakness of focussing power may occur in young people in consequence of general debility, such as arises after depressing illnesses and overstrain. It is very necessary to avoid using the eyes upon minute work after such misfortunes, such use being likely to set up conditions similar to those which belong to 'old sight;' but in true old sight it is the lens which has lost some of its focussing power, whilst in the case referred to it is the muscular system which is at fault.

Spasm or cramp may arise in the optic muscles as well as in other parts of the muscular system, and cause derangements of sight, which may be temporary only, though when they are not recognised as such they give rise to serious and unnecessary apprehensions.

This brings me to the most important part of the subject in connection with school life, viz. defective vision, and the effects of school life on the sight. The various terms which are applied to interference with vision are old sight, or *presbyopia;* long sight, or *hypermetropia;* short sight, or *myopia;* and *astigmatism*, or an alteration in the uniformity of the curvature of the cornea, by which its spherical shape is lost, and it becomes more or less conical. Children suffer in various ways and from various causes from these conditions, independently of those changes which arise in the ball of the eye from interference with its nutritive or its absorbent power. The requirements of civilized life have much to answer for in this respect. The anxiety of an over-careful mother, because her little one fails to see objects very clearly at a short distance from the eye, causes her to take the child to 'an oculist,' as he is termed, who gratifies the mother by putting on a pair of spectacles, by which the short sight is rectified or the long sight corrected, and the mother goes home delighted with Mr. So-and-So as being almost a magician. Her child now sits down at the piano, and plays away to her heart's content, and perpetuates the mischief,

Long sight.

Short sight.

which really required abstinence from such work for its cure. This is altogether wrong; no effort is made to rectify the constitutional fault. The weak muscle, instead of being gradually strengthened, is left to its weakness, and spectacles probably become necessities for that child to the end of its career, or until some change takes place by which the other muscles are equally reduced in tone, and the difference of focussing power is removed. By this time, however, spectacles have become parts of the constitution, and the child (now grown up) cannot get on without them. It was stated not long ago in the *Times*, on the authority of an eminent ophthalmic surgeon, that 'our public schools are manufacturing a race of short-sighted people.' I do not agree with this dictum as regards the manufactory itself, because, as a rule, public school life is that which is more conducive to its prevention than that which holds in a large number of private schools. Still, it is a fact that the coverings which make up the eyeball in the child are not all alike as to their natural firmness of texture. It may therefore follow that a child whose fibrous tissues are weak, and the eyes extensible at the back, will keep a book nearer to the eye than another and a stronger boy. The muscles are put upon a strain; the ball of the eye yields and becomes elongated from before backwards; the lens is pressed nearer to the cornea, and short sight is increased. The book gradually gets nearer and nearer, and mischief to the eye is made permanent. The ordinary influences of school life are especially hurtful to this state. The eyes are employed for long periods over books which are often badly printed, or printed in a type which is much too small and difficult to see. The light of the room is very often defective. and the position occupied by the child gets cramped

Good printing necessary for school books.

from habit, so that the muscular weakness is increased by it. One set of muscles are strained or over-taxed, another set are put out of use altogether, and thus gradually lose a part of the power which naturally belonged to them. English schools are not the greatest offenders. It has been noticed that at gatherings of scientific men, such as that which took place in London in 1881 at the meeting of the International Medical Congress, that the French and German medical men, as a rule, used spectacles, whilst with English physicians it was the exception. It is said that the same fact is patent wherever learned men assemble on the Continent. Continental bookworms have taken to glasses in early life much more generally than English literati. The attention of sanitarians has been called to this, both at home and abroad. It has been imputed to the faulty construction of the seats and desks in our schools, the bad habits of the child-student whilst reading or writing, the desks being too low, or the seats too far removed from the desks, forms only being used, when the seats ought to be provided with rests at the back; or they are so placed that the eyes of the children are brought into too close proximity to the object, and in an oblique instead of a straight line. Habit has led to a curve in the spine from sitting on one hip, or leaning the arm upon the desk, and bringing the eyes to a focus whilst the book or paper is placed on an irregular or oblique base, and thus the muscles of the eyeball are unequally strained (see pp. 146, 147). It has been found from actual inspection that the majority of short-sighted children have lateral curvatures in the spine. The spinal column ought to have a straight outline on both the right and the left sides of it, the curves being restricted so as to accommodate themselves to the

English sight disturbed less than continental.

Effects of bad position.

Lateral curvature associated with short sight.

cavities of the body, and be only from before backwards, or *vice versâ*. It has been seen that the column bends to the right or left, according to the custom of the child to lean on one arm at the desk, or to twist one shoulder forward before the other, by which means the muscles on that side are brought into more forcible action, becoming stronger than their antagonists. The child sometimes has been allowed to get into the habit of standing on one leg, by which the corresponding hip is raised to a higher level than the other side, and a compensating curve is brought about in the dorsal region, by which the tendency to lean over to the other side is rectified. The association of short sight and lateral curvature has been clearly made out by *Cohn*, of Breslau, as well as by observers in America, and also in the United Kingdom; it has been clearly associated with anything which tends to increase muscular or osseous debility. The cure for this condition ought not to be spectacles, but regular use of muscles and alteration of muscular custom. Our object should be alteration of habit, improvement of general health, and as much disuse of the overused muscles as can be brought about by a pleasant kind of exercise. Teachers and managers must keep this point in view. Spines with lateral curvations are becoming very common in this country, especially among girls, and are much too often associated with spectacles. This association enables the teacher to go on with his teaching duty as regards books, but lets the more important point of muscular development be in abeyance. Glasses save trouble to the teacher, but perpetuate the muscular irregularity, and but too often lead to permanent debility. If we could follow these cases in after life, and see the misfortunes which happen to them from this prostitu-

Spectacles not a cure.

tion of one faculty to overwork with the effect of permanent injury to another, we might hope for amelioration. A school in which there are a great number of short-sighted children has something wrong either in position and condition of seats and desks, or in the arrangements of light, or the customs of the school as to ventilation and exercise, and calls for serious inquiry on the part of the managers. Children with short sight should read together, and should be drilled into the use of those muscles which regulate distance. They should be encouraged to use those which are defective, and not to put them still further out of use, and every effort should be made to compensate for the increased vigour of those which have been used too much, as compared with their antagonists. Not only should this rule be followed in school, but these children should be classed together out-of-doors, so that the exercise may be in accord. Those with lateral curvature, when the curve is caused by bad habit, should have that habit corrected by an enforced exercise of the weakened muscles, as by insisting upon battledore and shuttlecock with the right hand tied behind the back, so as to bring into more active use the left arm and the corresponding series of dorsal muscles. The skipping-rope should be used afterwards for a few minutes to bring both sets into accord. If the habit has been a left-handed one, the opposite action should be encouraged. The offending optic muscles should be encouraged to equal action by looking at objects placed at a given distance, and being made to recede in a straight line, whilst the position of the child when at work which requires the steady use of the eyes should be rigidly regulated: the shoulders kept in a parallel line, the elbows to the sides, the back upright,

A school with many short-sighted children in it has something wrong in its arrangements.

and the line of the paper or book upon the desk parallel with the line of the shoulders, the seat itself being regulated according to the length of the back of the worker. Tall children should work with tall children, and short ones with short ones, or else the height of the desk must be made to vary according to stature. The feet should rest upon the ground, so that there must also be a regulation as to the length of the tibiæ in a given class, unless the seat be raised or lowered according as the child has long legs or short ones. Some children have long legs and short backs, others have the contrary; to set such to work together is a course which will assist in developing short sight, and lead to optical defects in both kinds, because the muscles of one set will be strained whilst the other will have less to do, and as a consequence will lose tone and power (see page 98).

Children must be classified according to size.

I had the privilege of presiding at a lecture given by Liebreich at the Social Science Association some years ago, in which he dwelt very forcibly upon the injurious effects of habits in schools upon the sight of the learners. It impressed me very strongly as to the mischiefs which accrue to children from attempting to remedy the evils produced, unless the attempts are made in a scientific manner, and upon a correct basis. The size of the printed matter which is used, the direction from whence the light is obtained, and its incidence upon the paper, the position of the learner, the intensity and nature of the light, and the alternation of light and shade caused by shadows upon the desk, are all matters of importance in arranging a class in a schoolhouse or classroom, and must always be taken into account if teachers are to be produced with perfect sight.

CHAPTER XVI.

HEARING AND THE EARS.

Deafness either temporary or permanent.

DEAFNESS is a terrible misfortune to teachers; it may be caused by functional derangement, and be temporary, or it may arise from actual disease, and then may be either temporary or permanent.

Explanation of sense of hearing.

The organ of hearing consists of a number of parts, which are most complex and elaborate in their character and construction. The external ear is simple enough, but the arrangements of parts in the internal ear are so intricate, that it is perfectly impossible to make them understood without models and a considerable acquaintance with the laws which regulate acoustics, and it is no part of my plan to go into the physiology of hearing; but I may state that vibrations of the air are conveyed by the external ear and by the auditory canal to the tympanum or drum, which stretches across the bottom of the auditory canal, and apparently limits its length. The rays or currents of sound collected by the external ear impinge upon the tympanum and cause vibrations, which are felt by the ossiculæ or little bones on the other side of the drum, with which they are in direct contact. This chain of bones conveys the vibrations to the auditory nerve, the sound being reverberated and magnified by passing along a series of canals or passages, some filled with air, others with fluids of varying densities, until the tremor of the sound itself reaches the expansion of the 'portio mollis,' the most sensitive part of the seventh pair of nerves, and by it the impression is conveyed to the brain.

Ear divided into external, middle, internal.

Description of internal ear.

The ear is divided into the external, middle, and internal ear. The drum is a membrane at the bottom of the passage, which leads into the head from the concha or external ear. It divides the middle from the external ear. The middle ear is not, however, shut off from direct communication with the outer world, for it receives air from the throat by means of a passage called the Eustachian tube. It contains a series of contrivances for multiplying sound, which are wonderfully protected from injury, and which, when injured or displaced, lead to deafness, greater or less in intensity according to the damage which has been done. This small cavity—less than half a cubic inch in size—has a chain of bones of very defined angular and branching construction, with ligaments, muscles, and nerves, which are excessively delicate. Interference with their faculties induces disturbance of function. The lining membrane of this cavity is highly sensitive and vascular; it is continuous with the membrane in the throat by the Eustachian tube. That in the tube is covered with vibratile cilia and mucus glands, which pour out a thick secretion, but that lining the tympanum itself has neither cilia or mucus follicles. The internal ear is in the structure of the temporal bone. It is wonderfully protected. It contains the most sensory part of the ear. There are several canals placed at different angles—a vestibule into which the canals open, winding staircases (the cochlea or shell), sounding membranes, with a clear fluid in which the membranes lie, all being most intricate in structure, and enclosed in bones called collectively the osseous labyrinth. The parts with which we have more particularly to deal are the external ear and the Eustachian tube at its opening in the throat. Disturbances and diseases of the middle and internal ear are among the most dangerous of the ills to which the human body is liable, and only call for mention in this place. The most serious are those connected with inflammation of any part of it, giving rise to effusion or abscess. Convulsions, coma, and death result, unless the effused fluid quickly makes its way out by one of the possible openings. The disease and disorders which I propose to deal with may be divided into two classes—those connected with the external ear, and those connected with the throat. The ear may be likened to a trumpet reversed, the narrow part being in contact with the tympanum. The passage called the external meatus may be stopped up by excess of secretion, by foreign bodies, or by unnatural growths. The meatus is lined with excessively fine hairs, and is kept from dryness by a secretion of glutinous matter, which is usually called wax; if it becomes inspissated and adherent to the hairs, it forms a plug, which may effectually prevent the admission of the waves of sound, and prevent them from impinging upon the drums, thus producing deafness. The same condition arises from the admission of dust, fluff, or pieces of cotton wool, which are sometimes designedly inserted to keep out the cold. This state of things is very often a cause for *earache*. If a person having such a plug in the ear happens to bathe or admits water into the ear by any means whatever, so that the plug swells up, it presses upon the sensitive parts of the organ, sometimes producing the most acute suffering, and

External ear.

Earache from foreign bodies.

effectually prevents the access of sound to the tympanum.

Earache of this kind is remedied by hot fomentations, such as bran poultices and the use of a douche, or syringing out the ear with warm soapy water, until the offending plug is extracted. I have sometimes removed plugs as large as a Minie rifle bullet. Earache also arises from cold; a swelling of some of the follicles takes place, or a minute herpetic eruption may come out, such as is accustomed to appear under similar circumstances upon the lips. Time and a little sweet oil are the only things necessary for the treatment of this class, unless the herpetic spots should be large in size or proceed to suppuration. Then the action of the jaws, as in masticating, is painful, and the general health is much disturbed; warm fomentations and such treatment as may establish a diaphoresis (or a good sweating) is the best course to be followed. Earache arises also from an eczematous state of the skin. It is usually a part of a more general disease, and must be treated as directed under the head of *Eczema* in 'School Surgery.' An absence of proper secretion also causes deafness; the meatus is dry and shining, so that there is no proper conveyance of sound. This is remedied by the frequent insertion of a drop of almond oil, with a particle of glycerine, or a drop or two of Friar's balsam, dropped carefully into the passage, and the ear syringed out every day with warm, soft water.

From cold.

Dentition.

Earache is often associated with dentition, as when the molars are being developed, especially the wisdom set. There is generally some error of diet connected with this disturbance. This is popularly known to be the case, as, when any person's ears are seen to be excessively turgid, it is said that he is suffering from the effects of indigestion. A legend is attached to the condition in some parts of the kingdom, and it is said that somebody is walking over the sufferer's grave, or is talking about that particular person at that particular moment; it is, in reality, an evidence of indigestion. This condition is liable to set up various disorders, such as temporary deafness, ringing noises and different kinds of sounds in the ears, with headache and the other accompaniments of indigestion, or it may culminate in apoplexy. Treatment must be directed to the first cause, viz. the digestive organs, and not to the ears.

Indigestion.

Neuralgic earache may be produced by decayed teeth irritating the ganglia in the ears, which are closely connected with the dental nerves, as well as with the facial, which are distributed to the skin of the side of the face, and which are especially liable to be influenced by cold blasts of air. This form of earache must be treated in the same manner as similar neuralgic conditions elsewhere. It is often kept up by miasms and unhealthy habits of life. The cause must be removed in preference to the use of remedies, which often give relief for the moment, but which make the disease more permanent. Stimulants, such as wine and spirits, and all narcotics, such as chloral, opium, and morphia, are to be avoided as deadly poisons. They lull the sufferer by paralysing the nerve which is the source of pain; they do nothing whatever towards removing the cause of the disease, but, on the contrary, the cause becomes more rooted, so that the disease itself is more and more confirmed according as the sedative or narcotic is indulged in to a greater or less extent.

Neuralgic.

Remove causes.

Narcotics and stimulants are poisons.

Ordinary earache of a neuralgic character, or that which arises from any of the preceding causes, may be distinguished from inflammatory affections by the absence of fever, the pain being of a shooting rather than of a throbbing kind, by its sudden onset, and by its intermittent character. The neuralgic form is sometimes called *Otalgia* to distinguish it from *otitis*, or inflammation of the ear.

Discharges from ear.

Otorrhœa, or purulent discharges from the meatus, sometimes of the most offensive character, are not uncommon; indeed, they are frequent complaints among children. They follow upon blows which have set up hæmorrhage into the middle ear, or other injuries which have caused the ossiculæ to be dislocated, and to necrose or die. The retention of decomposing pieces of inspissated wax is sometimes the cause of the discharge, or some foreign body, such as the dead body of some insect or other animal, which has been lodged in the ear. The chrysalis of an insect may develop from some ova laid in the felt-like mass which occasionally occupies the meatus, fungi may grow there and produce evil, or one of the little bones being dead and retained by its ligaments, acts as a foreign body, and sets up the peculiarly offensive discharge indicative of dead bone. Sometimes there is no foreign body or dead bone in the passage, the discharge being associated with a strumous or tubercular habit of body. It is then muco-purulent in its character, and proceeds from the mucous or cutaneous surface of the meatus. In all these forms of the complaint the greatest care is necessary that there be extreme cleanliness. The ear should be frequently washed with some disinfecting solution, such as Condy's fluid (a teaspoonful in a tumbler of water) or carbolic soap, and afterwards anointed with carbolized oil, whilst the general health must be rigorously attended to.

There is another class of cases which are extremely dangerous, which have supervened upon scarlatina or some other of the diseases caused by blood poisoning, and which are associated with caries of the portion of the temporal bone which encloses the sensory part of the organ of hearing. They are in the end generally fatal, and should be always under the care of a medical man.

A dangerous class of case follows upon scarlet fever.

The external ear is often liable to so-called *tophi*, or gouty concretions; a deposit of gouty matter (urate of soda) takes place in the tissue of the auricle, which shows as a white deposit after the inflammation which it causes at first has subsided. It is better to leave them alone, and to treat the gout by general means.

Gouty concretions.

Polypi sometimes form in the ear. These growths are usually hard and fleshy-looking, or they may be soft and gelatinous. The surgeon will easily remove them by means of forceps and a wire snare. They require to have the base from which they have been removed touched occasionally with a little nitrate of silver, and the passage syringed out with carbolized water every day for some time after their removal.

Polypi.

Obstruction of the Eustachian tube.—This is often a cause of deafness. It is necessary for perfect hearing that air should be conveyed from the mouth into the cavity of the tympanum. If the channel is obstructed, more or less deafness results. The opening of the tube is situated in the throat behind and above the soft palate and tonsil, and in close proximity to the posterior nares. The trumpet-shaped opening is covered with columnar and ciliated epithelium, which secrete and convey mucus from the ear to the throat. A relaxed throat or simple cold causes deafness by leading to an obstruction in the canal; the character of the secretion is altered just as arises in the nasal

Obstruction of Eustachian tube.

Other changes in the throat.

organ when its faculty is interfered with. Deafness also may arise from ulcers in the throat; it follows upon the sloughing which sometimes occurs in different forms of sore throat, also in scarlatina and diphtheria. It may be caused by the descent of a nasal polypus from before backwards, and enlarged tonsils may block up the passage and prevent perfect hearing. All these conditions impair, but do not destroy, the hearing. They are all capable of diminution by appropriate treatment. The effects of the cold will disappear in the course of time. The cause for the ulceration must be searched out, and, if constitutional, it must be treated properly. The polypus must be removed by the surgeon, the condition which gives rise to enlarged tonsils remedied. The local application of tannate of glycerine to the throat above each tonsil will often be successful in getting rid of depraved secretion, and will cure the relaxation upon which it may depend. Much may be done by local and constitutional treatment, but instrumental interference, as occasionally practised, more often leads to further deafness than remedies that which already exists. I have never met with a single person who has been really cured by the passage of instruments into the tube, but I have met with some who have been evidently made worse, and sometimes irretrievably damaged, by such treatment.

Surgical interference, except of the simplest character and for the purpose of removing extraneous bodies or distinct polypi, is to be deprecated.

Three kinds of deafness.

Deafness may be considered under three heads:— (1) That in which the faculty is completely annihilated. (2) Hardness of hearing, in which articulated sounds cannot be heard without artificial assistance. (3)

Alteration or diminution of hearing, in which there is want of precision.

Total deafness must be assisted by sight.

Those in whom the faculty is completely annihilated cannot be helped unless the organ of sight is capable of assisting. The pathological condition of the nerve of hearing prohibits the thought of recovery. The most comfortable course for the sufferer is to acquire the capacity of understanding the language of the dumb, and to have an interpreter at hand who can talk with his fingers. The totally deaf person sometimes obtains great help by lip language, but it is uncertain and too intricate to be described here. The best aid is to be obtained by means of the dumb alphabet, and if there is total deafness, it is best to converse by writing on the slate, or with the fingers, and not to attempt to make the deaf person hear.

Those partially deaf.

The second class, viz. those in whom articulate sounds are heard with difficulty, and who yet may be assisted by artificial means, are the most numerous, and also the most troublesome class. Some will resent the idea that they are deaf, and insist upon people speaking up, accusing them of lowering their voice on purpose; or they become suspicious, and believe that those about them are talking low because they don't want the deaf person to hear what is being said. They are often, also, very inquisitive, wishing to have everything explained to them even to the smallest detail, whether it be important or not. There is a curious difference between the mental resignation which so often attends upon the nearly and the totally blind, and the irritability and suspiciousness of the partially deaf. We must suppose from the frequency with which the difference is observed, that the roots of the auditory nerve become affected by the condition which give rise to the deafness, and that this irritates

Difference between those deaf, and those blind.

the neighbouring nerve cells, and conveys the impulse to some part of the brain connected with the organ of thought, and thus produces the mental state which gives rise to irritability and suspicion. These cases are sometimes much helped by various forms of ear-trumpets; none are better adapted to collect sound than the human ear, and it is simply by enlarging its area that we obtain help. The object of the ear-trumpet is to collect vibrations from one direction and to exclude others. If the tympanum is pervious and the middle ear damaged, some assistance may be obtained by its use; the simplest form of trumpet, with a well-expanded mouth, is the best. There are some very expensive kinds, which are supposed to be of great service, and so they are to their sellers; they fill the pockets of their designers, but a half-crown lacquered tin instrument will be as effectual as one for which several guineas has been paid. Those small instruments which are sometimes advertised as fitting under the cap and into the cavity of the ear, and are thus invisible, are more likely to be injurious than beneficial. I advise all deaf persons to keep their money in their pockets, rather than invest it in such useless contrivances. Conversation tubes are such as have a comfortable ear-piece with a long elastic tube, terminating in a small trumpet-shaped opening. This is held in the hand of the speaker, who speaks into it, and the listener is thus able to hear what is said by that individual, even if he be on the other side of the room, whilst there may be a general hum of conversation all over the room. These tubes correspond in effect to the speaking-trumpet which is sometimes affixed near to the doctor's night-bell, and as often misused for the purpose of practical joking as for actual use.

Ear-trumpets simple are best.

Expensive apparatus useless.

Conversation tubes.

The third class, viz. those in whom there is an alteration or diminution of hearing for want of precision, are very often cases which cause much trouble to the teacher, as they are common to the young of both sexes. Boys and girls are inattentive, and such inattention causes a want of precision; they misunderstand the purport of the observations addressed to them. The boy begins to say, 'What did you say, sir?' before the master has finished his sentence; he has lost the first part from inattention, and in trying to catch it he loses the second, which, if he had listened for it, would probably have told him all that was necessary. In these cases there is usually some thickening of membrane in the Eustachian tube which causes delay, so that the condition of the middle ear is altered. Sounds reach the tympanum on the one side before the middle ear is ready to transmit them, or the successive sounds are mixed up and confused when they reach the auditory nerve itself, because the muscles are late in responding to the vibration, and do not respond until too late. It is important that young people should be broken off the habit of interrupting by asking, 'What do you say, sir?' The sentence of the speaker should be completed before inquiry is made as to what has been said. Inattention has much to do with the production of this class of disease, although in some it may arise from causes beyond the control of the individual. The muscles of the ear, as well as those of the eye, or those of the fingers, can only be brought to perfection by exercise and studied use, and if they are not brought into use, as is the case when a person is listening inattentively, they will lose their power of precision, and be unable to appreciate the delicacy of sound, which is pretty sure to come if it be properly

Deafness from inattention.

Muscles out of harmony.

educated. If two persons are compared of equal health and strength, one of whom has been brought to distinguish the difference of sounds, and the divisions which can be made in them by the study of music, while the other has never paid any attention to music or its charms, it will be seen that the hearing of the musician is much more acute, delicate, and exact than that of the unobservant listener. Whenever there is a diminution of hearing from want of precision, the subject of it should learn music at once, and so bring into play the muscles which are defective in their action, for it is certain that musicians, as a rule, are much less liable to suffer from deafness than any other class of persons.

Musicians not very liable to suffer from deafness.

Deafness may be prevented.

The prevention of deafness is the best method which can be adopted for keeping the ear in a healthy state. It is specially necessary if there should be any hereditary tendency to deafness. Some families have this tendency. Preventive measures are of several kinds. The ear is a very delicate organ, and must be protected from cold air blowing exclusively upon the auricle; this applies to those who are subject to earache, or to discharges from the meatus. It is unwise to be poking the ear for the purpose of dislodging any material which may be thought to have invaded the outer passage. Beyond the use of warm douche, it is dangerous to do anything to the internal part of the ear without skilled advice. Attention to the general health is very necessary. Those who have a gouty or rheumatic habit, will do well to recollect that the ear is especially liable to be invaded by those diseases, and if there is deafness coming on from these causes, it is probable that a restricted diet for the gouty tendency, and warmer clothing for the rheumatic, may be among the preventive measures which should be taken.

Keeping in mind what has been said as to the alteration and diminution of hearing, which comes on from want of precision, it is important for those who observe such a condition arising in a young person, to take measures to arrest its continuance. If it is found that there is no evidence of change in structure to account for the deafness, the child should be made to practise as to the distance at which sounds can be heard, both as to character of tone and quality of pitch. If there are several children in a large school who can be classed together, they should be drilled, and made to listen for the tick of a watch or tone of a tuning-fork, and to try and hear it from a greater distance on each occasion. It will be found that education will develop precision, and diminish the chance of permanent deafness arising from some of the minute muscles of the ear becoming paralysed or undeveloped for want of use. They are voluntary muscles, and if not used will certainly lose precision and power, just as any other set of muscles must do.

Remove cause rather than treat result.

Finally, the teacher who is growing deaf, will wisely determine the cause of the deafness, and take measures to remove that cause, rather than treat the result. If the general health is attended to in a proper manner, and there are no local conditions giving rise to it, there is no reason in the abstract why deafness should be established, and therefore no reason why the teacher should become incapacitated from his duty by that defect alone.

CHAPTER XVII.

THE THROAT AND VOICE.

As deafness is often associated with certain changes in the condition of the throat, it will now be convenient to take into consideration those which interfere with the perfection of the voice, and the maladies which specially affect the throat. Very few persons pass through this life without having at one time or another some complaint of which hoarseness and sore throat are parts, or even the whole of the malady. The major portion of the causes which set up cough are in the throat. The constant cough, which disturbs every school in changeable weather, is generally due to some relaxation of throat membrane. The throat may be irritated by an atmosphere which is too dry, as well as by one which is loaded with particles of foreign matter, as happens in some factories. Some persons have a distinct proclivity to sore throat, either from hereditary tendency, or in consequence of a local weakness which has been the sequence of a preceding attack of scarlatina or diphtheria, or the result of some syphilitic affection. The custom, also, of smoking must have an effect upon the mucous membrane of the throat, rendering it more susceptible of changes as to temperature and moisture. Breathing an atmosphere laden with tobacco-smoke, such as is

Causes of cough more frequently in the throat.

Smoking causes relaxation of membrane.

found in the sitting-rooms of public-houses, in low concert-rooms, and in other similar places of assembly, is very likely to set up a liability to relaxed throat. The long-stemmed pipe—the old 'churchwarden,' as it is sometimes called—is much safer, because the smoke is cooler than that which proceeds from the short cigar. A long cigar, only half of which is consumed, is the next best way to use tobacco; short pipes are not safe, and cigarettes are the most injurious of all. The great tobacco-smoker is revealed by an inspection of the throat, even if he is not known by his sallow face. Sudden exposure to a raw, cold air after inhaling a hot atmosphere, such as happens when persons come out of a badly-ventilated building crowded with persons, and pass into a colder region, produces relaxed throat. Teachers who will not ventilate their schoolrooms properly, and clergymen who preach in hot churches and chapels, are especially liable to this condition, by which a state called the 'clergyman's throat' is easily produced. Persons who have been sitting near a large fire, so as to get the pores of a portion of the body thoroughly relaxed, and who then pass into the outer air without making any difference in the character of clothing, suffer in a similar manner. Over-strained muscles, such as are produced by long-continued loud talking, protracted reading at a high pitch, screaming and talking for a long time to a deaf person, are all customs which produce a condition similar to a 'clergyman's throat,' in which muscle as well as membrane is put out of gear, and when it is so accompanied it requires a long time to restore the tension of the muscle and recover the voice again.

Clergyman's throat.

The use of iced drinks assists to promote relaxed throats, and so does the use of drinks which are ex-

Iced drinks promote relaxation of throat, intoxicating liquors also.

cessively hot, whether from the temperature being too high, or from the presence of spices or peppers; the excessive use of intoxicating liquors will keep a throat in a relaxed and uncomfortable state, and habits of intemperance will prevent such a throat from recovering its tone. The man (or woman) with a fine voice, the cultivated vocalist, the charming solo singer, risks the loss of his faculty by deadening the delicacy of his laryngeal nerves by the continued use of intoxicating liquors.

Sailors not liable.

Whilst, however, we must be careful to avoid certain kinds of exposure, it is important to recollect that too great care is also injurious. The sailor does not cover up his throat under any circumstances, and is not troubled with sore throat. The clergyman or the opera singer who muffles up the throat with wraps of all kinds is especially liable to such a misfortune. The inference to be drawn from this contrast is a decided and an important one. It is not advisable to muffle the throat after exertion when the body is warmed, but it is advisable to protect the warmed body, and, above all, to avoid the direct application of cold air to the larynx itself.

Structure of the larynx, or organ of voice.

If observation is directed to the customs of some of those affected by hoarseness, it will be seen that they do not use the respirator which Nature has given them. There is no natural evil which a kind Providence has not guarded against, and given us protection from its effects, when it is required. It is so as regards the larynx. This organ is most delicate. Like to the ear, it has a wonderful set of nerves and muscles, regulated both by the will and also by involuntary action. It has numerous cartilages which strengthen its softer parts. There are filaments called the vocal chords, regulating the size of the aperture which constitutes the gate of life (janua vitæ). This aperture is a slit between the chords, and is called the slit or chink of the glottis ('rima glottidis'). This chink is covered by the epiglottis, which answers the purpose of a lid to cover over the slit when the act of swallowing is performed. Foreign substances are thus prevented from entering the larynx and passing into the trachea (or wind-pipe) when food or drink is swallowed. This does happen occasionally by accident when a person laughs, or is seized with some sudden and irregular muscular action whilst in the act of swallowing. The vocal chords are four in number. The two which are inferior produce the sound of the voice by their vibration. The rima glottidis is between these two. The chink is lancet-shaped, the point being turned forward, and it widens behind. It is nearly an inch long in the adult, and about a third of an inch wide in its widest part, its dimensions being less in the female. The superior chords or false vocal chords are much wider and less defined than the true. The ventricles or sinuses of the larynx are between the chords. They form 'cul de sacs,' named the laryngeal pouches. All these parts are lined with very sensitive membrane, which is supplied abundantly with nerves from the superior laryngeal branch of the pneumogastric nerve. It is upon the correct application of these parts to each other, and their ability to respond to the impressions made upon them, that the delicacy of the sounds of the voice has its origin. The muscles which regulate the movements of the membrane are excessively minute. Their action is both voluntary and involuntary, and any disturbance in the function of the part, either by relaxation or overaction, produces an alteration in the capacity of the membrane to respond correctly to the nervous stimulus, and to regulate the tone which is required, closing the chink or vibrating the chords as may be necessary for the production of the required tones. In man the power of song is entirely acquired. Early education of the muscles of the throat, assisted by the organ of hearing, produces the most perfect musical instrument that can ever be constructed. The power of speech is to some extent independent of the larynx, but that of song is distinctly associated with the perfection of this organ. We may whisper without any laryngeal vibration being produced, the action arising from the vibration of air in the mouth from back to front; but laryngeal tones may be produced without articulation, they are not necessarily associated with words. If we bear these distinctions in mind, we shall see some of the reasons for hoarseness and loss of voice when the mucous membrane is disturbed in its proper function, or when it is too moist, or less moist than it ought to be. This disturbance is brought about by intemperate action in declamation, by the too long-continued strain which the muscles have to endure sometimes, and in the irritating nature of the air which is directly applied to the membrane. The respired air ought always to be within certain limits as to temperature. Nature gives us a means whereby these limits may be preserved. She has provided a respirator which will warm or cool the air we breathe, if we will only use it properly, viz. the nose. The structure of this organ is so arranged, that it presents a very large expanse of mucous membrane over which the air has to pass, and by means of which it is both filtered and warmed. If we would always use the nasal organ as the proper apparatus through which air should enter the lungs, there would be much fewer laryngeal disturbances than are now met with. This caution is more especially

Power of song is entirely acquired in man.

Temperature of air must be within certain limits.

Persons having delicate throats should breathe through the nose.

necessary to be thought of and acted upon by those who have delicate throats than it is by other people. It would diminish delicacy of the vocal organs without making them more tender, if all persons would breathe through their noses instead of using their mouths for that purpose.

I mentioned the source of the nerve influence as coming from the pneumo-gastric. This is an important factor in connection with throat affections, for they are very often associated with the stomach. Indigestion is reflected upon the organ of the voice, hoarseness and relaxed throat is often kept up by errors of diet, and if with this discomfort there is also the custom of walking about with open mouth, the larynx is sure to suffer sooner or later, and changes in its functional and muscular performances will be produced.

Respirators not often useful.

It is curious to see how careful some persons are to indicate that nature has been careless in her work, and left them unprotected. They wear some kind of respirator over their mouths, through which they breathe, and neglect the far more useful one which is always at command. One sees them go about the streets open-mouthed, and if the artificial respirator is not forthcoming, they suffer from an irritating cough or disagreeable hoarseness, because the particles of solid matter which are always present in the atmosphere of towns, are filtered in the larynx instead of in the nose, or the air respired is too cold for an over-sensitive membrane, which then resents the treatment. I strongly urge the teacher to follow nature, to use the nose instead of the mouth, and do away with those mischievous articles of clothing called respirators. This advice does not apply to the working-man who may be toiling in a dust-laden or otherwise poisoned atmosphere. In his case it is as necessary as any other kind of protection against the evils of civilization. His work compels him at times to breathe through his mouth, and respirators are a part of his harness when he is at work. Respirators only provide work for the special physician when they are used in everyday life, for they render the throat more sensitive and less able to bear those sudden changes of temperature and moisture in the air, which may come on at any time without warning. There are times when delicate people may wear them, but, as a rule, if there is a dense fog or a stifling atmosphere, caused by the presence of half-consumed products from a forest of chimneys, it is better for such people, if they can do so, to avoid exposure rather than to seek it. If they are obliged by the force of circumstances to brave its effects, then a veil with a double fold over the mouth, which shall to some extent leave the nose free, will be all that should be employed, unless by medical advice.

Better to avoid exposure.

Cold feet cause loss of voice.

One of the most frequent sources of weakness in the throat and susceptibility to soreness and relaxation, is provided by letting the feet get cold or be wet. Some persons always have cold feet in cold weather. It will be found that those persons are or have been accustomed to wear tightly-fitting boots and shoes. If children had never been accustomed to wear such things, they would never be troubled with the sequences of cold feet, any more than they suffer from cold fingers from not wearing gloves. The Scotch, Irish, and Welsh children used, until very recently, to run about without coverings to the feet, and were able to enjoy the comfort of warm feet, in the coldest weather, but as soon as they became accustomed to the use of leather coverings, the power to withstand the effects of cold was lost.

It would be a great advantage, at least in elementary schools, if children could be encouraged to do without shoes and stockings. They are not necessary, except from habit; their absence is often made an excuse for keeping children at home, whilst in many cases they encourage unhealthy dirt, and cover up that which ought to be rubbed off by contact with the best deodorizer which can be provided, viz. the vegetable and mineral matter contained in the soil. In such schools (if they should develop) a place should be provided for feet-washing, as well as for cleansing other parts of the body. In those districts in which this arrangement could not be carried out, it is highly important that the boots and shoes should have thick and impervious soles, so that the feet may be kept dry; also that there should always be sufficient room for circulation to be active, and the feet to grow. Tightly-fitting stockings and shoes, by preventing active circulation, lead to a diminution of the calibre of blood-vessels, and, therefore, to a diminished supply of blood. There is a diminished supply of heat, and as a consequence cold feet are certain to be present.

Baro foot in warm schools.

If boots are worn, feet must be kept dry.

If people with tender throats provided themselves with plenty of blood-supply, by allowing a free circulation in the feet instead of using artificial warmth by means of hot bottles, foot-warmers, and all such luxurious articles, they would find themselves much less sensitive than they are. Nothing has tended so much to increase throat affections among the delicate as the use of tight boots, with the foot-warmers which are now supplied on most of our lines of railway. Very comfortable, no doubt, but it is very unwise under any circumstances for people in average health to trust to artificial supplies of warmth instead of providing it for themselves in themselves. Those who have delicate

Foot-warmers. not to be encouraged.

throats should be careful not to talk much when in the open air, if it is foggy or very cold. Talking requires them to open the mouth too much, and to some extent prevents them from breathing through the nose, and employing nature's respirator.

As boots and shoes must be worn they ought to be kept dry. It would be a great advance in day schools for the scholars and teachers to have a pair of dry shoes at the school, which they could change on wet days for their wet ones. To sit all the morning in damp garments tends to promote the formation of a foul atmosphere, to chill the body, and render the teacher, as well as the scholar, more prone to take on enthetic disease if it happen to be in the school. It gives the teacher no chance of having pure air in the classroom.

Goloshes only to be used for temporary purposes.

The custom of wearing india-rubber goloshes is not to be encouraged, unless there is snow on the ground, and even then, snow fur-boots are better. They should only be worn out of doors. Goloshes keep the feet very hot, and when they are taken off, the feet miss the warmth, and the owners are like to those who have travelled a long journey with a hot foot-warmer which has become cold and which cannot be renewed; they miss the warmth to which they have become accustomed, and suffer in consequence. They are like to naturally hardy plants which have been kept in a hot-house. They are quite unable to stand the consequences of cold, which they could have easily borne, and even have been strengthened thereby, if they had not been weakened by over-indulgence.

SORE-THROATS.

Fourteen kinds of sore-throats.

Sore-throats are of several kinds, viz. (1) Common sore-throat; (2) acute sore-throat; (3) quinsy; (4)

aphthous sore-throat; (5) the sore-throats of small-pox, measles, scarlet fever, diphtheria; (6) acute laryngitis; (7) chronic sore-throat, sometimes styled 'follicular sore-throat;' (8) the clerical sore-throat. There are also (9) enlarged tonsils; (10) tumours growing in various parts; (11) neuralgic conditions; (12) spasms in the throat; (13) naso-pharyngeal catarrhs; and lastly, (14) chronic coughs consequent upon mucous disturbances of the throat, and which can only be cured by directing attention to the source of the evil.

Common sore-throat.

(1) *Common sore-throat, or simple catarrh.*—There is general relaxation of membrane, with some hoarseness and uneasiness, but not actual pain on swallowing. It is very common among children, and often arises from exposure to cold after being in an impure atmosphere. If it be simple relaxed throat, it requires an equable temperature, a slight aperient with diluent drinks, so as to encourage diaphoresis, and no solid food should be taken. If there be fever, especially if there be pain on swallowing food, or any constitutional disturbance, medical advice should be sought for, as it is very difficult for the inexpert to detect the serious consequences which may arise from laryngitis or diphtheria. Two drops of tincture of aconite, with five grains of chlorate of potass, every three or four hours, will relieve the inflammation; this prescription is also a most invaluable one in acute sore-throat, taking down the inflammation in a rapid manner: it may, in the latter case, be taken every hour or two, and continued until all pain on swallowing is gone.

Acute sore-throat.

(2) *Acute sore-throat*, which is sometimes called pharyngitis, is an inflammation of the mucous membrane of the throat. Changes have advanced beyond the relaxed stage. There is usually fever and restless-

ness. It will get well in a few days if it is not ill-treated by caustics and other irritating measures, which are sometimes injudiciously used. It requires warmth, diluents, diaphoretics, and saline aperients. The free use of mucilaginous drinks, such as barley-water or linseed tea, and occasionally iced water or iced milk and water, will be the most successful line of treatment.

(3) *Quinsy* has been treated of in 'School Surgery' (*vide* page 221). Warm fomentations may be used to hasten the discharge of matter from the abscess. It is frequently associated with teething. Some children have an abscess in one or other tonsil with each tooth that is cut. Quinsy is usually preceded by a chill or rigor. This is followed by fever. It is sometimes accompanied by a most acute pain in the ear, in consequence of pressure upon the Eustachian tube, and the interference with discharge from the middle ear into the throat. There is often a nervous fear lest suffocation should arise. This has really never happened from simple quinsy, and need not therefore be feared.

Aphthous sore-throat.

(4) *Aphthous sore-throat* has a relaxed state of mucous membrane; there is a series of white spots upon the tonsils, and often, also, upon the tongue and gums. They are occasionally, even frequently, mistaken for diphtheria, and mistreated accordingly. The spots are seldom more than two or three lines in diameter, pale, ashy-looking: at first they are like blisters or papules in the skin; the mucous membrane is then denuded, and slight indented ulcers remain: sometimes the mucous membrane swells up and the indentation is not so manifest. They may then appear as if there was a membranous production upon the mucous surface. Those upon the lips and gums are easily cured if they be touched very gently with a

solution of nitrate of silver, so that the solution be applied only to the ulcer.

Sore-throats of fever.

(5) *The sore-throats of fevers, etc.*—Aphthæ sometimes arise in the course of some kinds of debilitating diseases, and frequently usher in the end. This event often happens in phthisis or consumption, in mesenteric diseases, and other states, attended by long-continued and exhausting discharges. Old women regard the onset of *thrush*, as it is called, as a fatal sign ; but in some fevers it simply indicates an exfoliation of the mucous surface, and corresponds with the desquamation of the cuticle, which is the sequence of scarlatina. This desquamation really follows after all acute fevers, but not being so rapid as in scarlatina, it is not so evident.

Of diphtheria ;

The sore-throat of diphtheria is very insidious. There is often a feeling of uneasiness only, scarcely calling for remark ; the voice not being affected. Persons coming in contact with cases of diphtheria, will sometimes keep the feeling to themselves, for fear of being regarded as nervous. If an expert looks into the throat of such an one, he may see a slight patch of ash-coloured mucous membrane on the fauces, which indicates the commencement of the disease. If this be healed at once, the mischief may be cut short and the evil arrested *in limine.* If it be neglected, the cacozyme upon which the development of the disease depends may find admission into the blood of the patient, and an attack of the disease has to be submitted to. Diphtheria may be local in its origin. That is, it may be caught, some of the germs which produce the disease being planted in the throat, gaining a settlement, it may be, with difficulty. The mischief, if attacked at once, may be eradicated, and the prolongation of the case prevented. It is probably the usual way in which the disease-germ finds admission ; but some constitutions are much more predisposed than others. The germ develops at once if the system has been prepared for it by the patient living in an unsanitary atmosphere, or upon an improper diet. In the one case the system is already prepared, and the onset of the disease is immediate ; in the other, the germ has to fructify and to reproduce itself, and so undermine the constitution, before it can gain admission as a colony, and be powerful enough to influence the whole of the body and set up the disease. If, therefore, diphtheria exists in a school, it is right to examine every day the throats of all who have been in contact with the case, or with the surroundings which have given rise to it, for some week or two after its first discovery ; the inspection should be continued for some ten days after the last case has appeared. The throat in all suspicious cases should be dusted with fine sulphur powder, or gargled with a weak solution of sulphurous acid.

If diphtheria has appeared, all throats should be examined.

The sore-throat of scarlatina is generally attended by more or less fever. It is always prudent to use the thermometer in any suspicious case, and if there is a decided rise of temperature above the normal point in any one who has a sore-throat, to place the patient in quarantine at once, and send for the ordinary medical attendant.

Acute laryngitis.

(6) *Acute laryngitis.*—This disease is not uncommon among teachers, especially those who will keep their classrooms too warm. It is an acute inflammation of the mucous membrane which lines the larynx ; especially that part of it upon the vocal chords and the epiglottis. Its danger arises from the accident of situation. There is none attending the same condition of membrane if it develops an inch or

two higher or lower in the throat, but a small swelling on the vocal chords and the epiglottis narrow the chink of life to an alarming degree in a very short time.

There is generally great constitutional disturbance, with difficulty of breathing and swallowing, with a dry, harsh cough, a hoarse voice sinking into a whisper, and a wheezing, hissing inspiration, rapidly terminating in asphyxia and death, unless the disease is arrested, or the surgeon comes to the aid of the patient, and cuts his throat to save his life; that is, makes an opening below the larynx, and allows air to find access to the lung by a short cut through the parietes of the windpipe. The treatment must be vigorous, such as an emetic, if the tongue is loaded, frequent doses of antimonials or ipecacuanha, hot baths, so as to produce rapid and free perspiration, and a moist warm air in the room. Care must be taken to distinguish the disease from diphtheria. It may be recognised by the sudden constitutional disturbance, and the dysphagia or pain on swallowing, without the ocular evidence of mischief in the fauces. It is not usual to find much pain on swallowing in the early stages of the infectious disorder; but it must not be forgotten that extension to the larynx is not uncommon in diphtheria, and then the symptoms are very similar to those of acute laryngitis.

Comparison with diphtheria.

The acute form of the disease sometimes comes on as a sequence to a chronic state when there is ulceration of the organ, as in some syphilitic forms, and in the progress of so-called laryngeal phthisis. The condition only requires mention here.

Clergyman's throat.

(7) *Chronic sore-throat*, *follicular sore-throat*, *and* (8) *clerical sore-throat* may be considered together. These conditions, once developed, are very difficult to

remove, on account of three or four different circumstances. There is a relaxed mucous membrane, which is kept up by the state of the constitution or by the habits of the patient. The mucous follicles in the tonsils produce a cheesy kind of secretion, which cannot get out by the ordinary duct; the follicle distends, then inflames, and the yellowish-white secretion escapes, leaving the follicle thickened, which excess has afterwards to be removed by absorption. In this form it corresponds to acne on the face, and is as difficult to remove. Each follicle must have the sebaceous matter picked out by a lancet, or eased out by the end of a surgeon's 'director,' and the throat painted with tannate of glycerine twice daily, at the same time gargling with cold water, and sluicing the outside of the throat with a cold douche night and morning. There is another form of sore-throat which is allied to herpes,—small blisters form on the vellum and palate. It is more painful than the follicular kind, which is attended by uneasiness only, except when a follicle larger than usual suppurates. The other circumstances which render those conditions difficult of removal are the constitutional habit, which may have either a tubercular or a gouty origin. The one requires a treatment somewhat opposite to the other. The affection is often allied with a dyspeptic condition, which is kept up by the unwholesome food with which the patient indulges himself; or the local irritation is daily continued by an irresistible habit of smoking; or the patient is utterly unable to give the organ that rest which it must have to recover from the effects of the mischief. In the case of the clergyman or public speaker, the relaxation remains in, or has extended to, the vocal chords. It can only be cured by a long-continued perfect rest

Only cured by rest and change.

of the organ and voice, with attention to and removal of the allied causes I have mentioned. Lastly, the mischief is often kept up by the patient continuing to live in an unhealthy habitation, or a malarious district. A change of air is followed by rapid recovery. A return to the same house is followed by a relapse. When this is the case, the only chance of complete cure will be found in a permanent removal from the place itself, if the insanitary state of the house cannot be altered.

Enlarged tonsils.

(9) *Enlarged tonsils* have been already alluded to. They follow upon follicular sore-throat for the reason above mentioned. The tonsils are oval-shaped glands enclosed in a fold of mucous membrane, and situated between the two pillars of the fauces. In my early days I used to remove them by means of a guillotine. I do not think I ever did much good by the operation, except when they became so large as to prevent the patient sleeping, or causing him to make so much noise in his sleep that others were disturbed by his noise. The enlargement may be got rid of by astringent applications and proper tonics, such as citrate of iron, and the continuous use of hædozone. The remaining conditions which sometimes invade the throat, cannot be treated except by experts, although it will be right to refer to the chronic coughs which are kept up by throat irritation. These conditions are frequently remedied, when the cause is local, by painting the throat over with tannin solutions, with tincture of iodine, or tincture of benzoin. When it is nervous only, the best remedies are those which strengthen the system without having a direct local action, such as the internal administration of iron, valerianate of zinc, and other tonics; but it is always best, in such cases, to get medical advice. The veins

in the throat become dilated after long-continued relaxation, and then the cause is very difficult indeed to remove,—certainly not by the operation of cutting the vein across, as is practised by some specialists.

There is a cough, which is sometimes kept up by irritation in the ear. It is spasmodic in its character; the cure is obtained by removing the source of irritation. Treatment must be directed to the ear, and not to the throat.

Spasmodic croup, and globus hystericus.

Laryngismus stridulus, or spasmodic croup, is a disease of a spasmodic nature, which attacks young children rather than schoolboys or teachers. It is allied to other spasms affecting the throat, and requires immediate medical treatment; not so the *globus hystericus*, which belongs to young women, but not exclusively to them, for it is common among teachers of both sexes. There is a throttling or suffocating feeling suddenly developed in the throat, which is entirely nervous, produced by mental causes in a constitution lowered by study or intemperance of any kind. It is hysterical in its nature, and must be met by appropriate remedies. The simplest are the best, viz. drinking a glass of cold water, removal into the fresh air, and the immediate section of any tight lace or other bandages which may have ligatured the frame; but it can only be cured by removing the penultimate cause, which, in most cases, is a vicious habit of some kind or other. *Aphonia*, or complete loss of voice, is sometimes hysterical, sometimes the result of paralysis; it often occurs after diphtheria, and will be recovered from by using constitutional means and the local application of galvanism.

CHAPTER XVIII.

MANAGEMENT OF THE VOICE.

VOCAL sounds differ in three important directions. Changes in the characteristics which belong to each of these regulate the ability of the vocalist or impede his natural power. These intrinsic divisions are as follows, viz. (1) Quality; (2) Intensity; (3) Pitch.

Quality of voice.

Timbre.

(1) *Quality*, '*timbre*,' is the peculiarity of sound which enables it to penetrate to long distances, and to set up those characteristics by means of which we recognise one voice from another, or the sound of the harp from that of the violin or organ. A musician will distinguish between two persons playing upon the same flute. We recognise our friend in the dark by the sound of the voice. The cause which enables us to make this recognition is beyond common comprehension, but it is connected with the shape or conformation of the series of waves of sound which together assist to make the changes upon which the difference depends. In every sound there is a fundamental or 'ground tone.' Commingling with it there are feebler sounds which bear to it simple relations of harmony, and which are styled by the experts in sound as 'upper tones' or 'over-tones;' when these are in perfect accord the effect is agreeable; if not in perfect accord there is a discordant tone, which is

Discord.

unpleasant, and is called 'discord.' All these combine to shape or form the vibration which is to produce the effect and determine the '*quality*.' There is harmonious combination of ground tones with upper or over-tones, and it is the delicacy of these shades which produce the *timbre* of the human voice. The capacity of a cultivated voice to prolong a series of notes is almost incredible. The quality of the voice is mainly dependent upon resonance in the cavities which are located in the face, viz. the mouth, nose, and throat. The vocal chords are the generators of tones, and alterations in the condition of the cavities alluded to will lead to alteration in the quality of the voice. We recognise a man with enlarged tonsils, or with polypus, by a characteristic sound in the voice; so also the loss of teeth at once interferes with the power of voice; the removal of a portion of the palate by disease, and indeed any change in any part of the vocal passages, influences the character and alters the quality of the voice.

Quality.

Dependent upon resonance.

(2) *Intensity* simply means loudness; it is connected with the size of the waves of sound or undulations set up in the atmosphere. These waves travel in every direction from the point of disturbance. The larger the wave the louder the sound. The longer the vibration the larger the movement of air; the shorter the vibration the feebler will be the sound which is produced by it.

Intensity means loudness.

(3) *Pitch.*—This is the range or compass of sound of which the voice is capable. The entire range of both the male and female voices is said not to exceed five octaves. There are but few individuals who can take in more than two and a half octaves in the compass of their own voice. The modification of pitch arises from variations in the tension of the

Pitch is the range or compass.

vocal chords, with slight variations in the rima glottidis. These variations in tension and shape are produced by complex muscular actions, by extremely minute muscles acting upon the various parts which make up the larynx. The pitch is also altered at will by the force with which the current of air impinges upon the more or less tightened chords, or hisses through the rima glottidis or chink with greater or less rapidity of movement.

Human voice governed by laws regulating sound.

The pitch, therefore, depends partly upon the number of vibrations,—the greater the number the higher the pitch; the intensity is increased by the shortness of the vibrating chord, for the shorter that chord is, the more rapidly it can vibrate in a given time. Hence it will be seen that the human voice is governed by the laws which regulate sound as much as any other musical instrument, and that any change in the condition of that instrument, such as arises in the slightest alterations in moisture, muscular power, or the delicacy of feeling, will be at once detected in the alteration which takes place in the pitch or the quality of the voice itself.

The acoustic properties of the voice can only be referred to as being a study of itself; but we may restate with advantage that rapidity of motion is coincident with height of pitch. We have not space to distinguish between isochronous, periodic, rhythmic, or so-called musical sounds, and those which are called discordant, or to the differences between music and noise. Apparently they are not convertible terms; yet music may be evolved out of noise by so arranging that the kinds of vibrations correspond, instead of being out of harmony. Neither have we space to describe the varieties of the human voice, but simply to name them: two may be said to belong to the

Bass and tenor, male; contralto and soprano, female.

male, viz. the bass and the tenor, and two to the female—the contralto and the soprano; but we occasionally find them transposed in the sexes, a female being bass and a male soprano, which transposition is not always pleasing. The difference in the shape of the resounding parts, and the capacity of the chest and larynx, in the sexes, leads to differences in the quality, intensity, and pitch of the voice; which differences are caused by alterations at different ages, so that after puberty there are distinctions which are not found in boys and girls. These come out as puberty approaches, and lead to alterations which are most marked in boys when they reach a certain age, and which change the capacity and character of the voice. The vocal organs in children are comparatively small, that is comparing their volume with that of the whole body. As puberty is reached, they enlarge; there is a marked alteration in girls, but not to the same extent as in boys.

Vocal organs enlarged at puberty.

It should be an axiom with teachers, that sustained vocal exercises should not be carried on whilst the voice is breaking and the accompanying alterations taking place. It is very important that this should be thoroughly understood. As soon as a child shows an alteration in the usual tones of his or her voice, there should be a cessation of systematic teaching and of continuous vocal exertion. Instruction in the distinction of tones cannot be commenced too young,—it may begin as soon as a child understands the meaning of terms; but it must not be persevered in after the change of voice has commenced,—at least as regards a sustained effort. In girls the change begins between twelve and thirteen, with boys between fourteen and sixteen, and is completed in one or two years. The pitch falls an octave or more in the latter, and any

Pitch falls when the voice breaks.

attempt to keep it up to its ordinary quality is likely to injure the organ and deprive it of its sensitiveness. When, therefore, a teacher perceives that a child's voice is changing, the lesson should be interrupted until the change is perfected; at least as regards those lessons in which the capacity of the voice, its intensity, and its compass are brought into play. The child should not take part in any musical exercises beyond those of the simplest character. The ear may be instructed, but the vocal muscles must not be strained. These observations, from the doctor's point of view, have reference to the development and education of the organ of voice—to a so-called vocal culture. Professional vocalists who act as teachers do not always agree with these views, and much mischief results from ignorance regarding nerve and muscular development in cultivating the voice. The same kind of mischief arises in the cultivation of the organ of hearing, and in training for muscular contests in the playground, when these organs are used without judgment in excess of their powers. A teacher of music who practises his artistic powers in opposition to the teachings of physiology, is sure to damage the health of his pupils. Teachers should get an anatomical knowledge of the organs of the voice, and some acquaintance with muscular power and development, which will tell them that the minute muscles of the larynx will not bear a long-continued action, such as assists to set up the very numerous vibrations required to produce musical sounds; they will be overstrained by the action. To harp too long on one string is sure to do mischief in the end, and when that string is a vocal chord the mischief may be irremediable. The pupil always has a tendency to copy his or her master's tones and actions. It is

Then instruct ear, but don't strain voice.

important that this should be borne in mind, and that whilst a woman may teach a child of both sexes, she cannot safely teach young men. For the same reasons it is not wise for a man to be entrusted with the cultivation of young women's voices; but men and women should only be taught by their own sex when vocal culture is the study. It is also necessary to recollect that the extreme delicacy of the organ of the voice requires continuous cultivation for continuous excellence. If a cricketer or violin-player is out of practice for a month, the loss of practice tells upon his power in the delicate use of his muscles; that loss is much more manifest in the vocal muscles than in the muscles of the arms and legs. Intermittent exercise is not productive of perfection when the intermission is for considerable intervals; exercise should be regular every day, and also nearly equal in amount. The vocalist must practise daily if he wishes to keep the voice in proper condition, so as to be able at will to bring out the extreme delicacy of tone which perfection demands. It is for this reason that amateurs do not, as a rule, equal professional vocalists in their capacity, their timbre, or their pitch. Persons who wish to excel in any one of the senses, whether it be touch, taste, hearing, or in delicacy of vocal exercises, must not use the part upon which sensitiveness depends in an improper manner. We may learn a lesson upon this point from the workhouse and the prison. If a man who depends upon the delicacy of his touch for a livelihood is set to pick oakum, or is sent into the stoneyard to break granite into small pieces, he soon loses his power to continue his occupation, say as a painter or printer; his delicacy of touch is lost by his change of occupation. The police easily detect the impostor who describes

Young men and young women only to be taught by their own sox.

Practice is necessary every day.

himself as that which he is not, by an examination of his hands or his feet. The use of an organ in a given way affects the shape and the sensitiveness of the organ. That which applies to touch applies equally to vocal powers, and an improper use of the voice leads to changes in the tissues of the larynx, which show their effects to the end of life. The occupation of a man may be in some cases disclosed by his mode of speaking, as well as by the examination of his hands. Conventional and affected methods of speaking produce changes which are uncomfortable. The clergyman's throat has been already dealt with. It is not confined to the clergy; yet barristers and others, who are constantly engaged in speaking for long periods together, do not suffer as a class, because they speak with their natural voice, and do not try to sustain a pitch which is unnatural to them. Costermongers, on the other hand, and those who use their voices at the highest possible pitch, are frequently subject to mischief in the organ.

Vocalists should use diaphragm as much as possible.

If we watch the movements of the chest in vocalists, it will be found that those who use the abdominal muscles to the greatest extent are able to continue to use their vocal powers with the least fatigue and distress, whilst those who cause the upper part of the chest to expand whilst singing are most fatigued by their work. The inference which the teacher should draw from this fact is, that everything which interferes with the descent of the diaphragm (that is, the muscle which separates the lungs from the stomach, liver, and other abdominal organs) should be discouraged. A hearty meal is an impediment to vocal endurance; so is flatus, which may arise from emptiness and indigestion; but that which interferes most with the performances of ladies, is the pernicious practice of

Tight lacing interferes with correctness of tone.

wearing closely-fitting corsets, and the use of belts of all kinds round the waist. A female performer who has a tightly-fitting corset, or a tight band of any kind round her waist, is diminishing her excellence to the extent that such a mode of dressing has in preventing the descent of the diaphragm, and causing her to dilate the upper part of her chest. In such an one we see the collar-bones rise to a considerable extent. The muscles of the neck are brought into visible play, and the exertion of singing, and the fatigue which follows, is very much greater than in one who allows the diaphragm to descend, and uses abdominal respiration to a greater extent than the clavicular or collar-bone inflation. This is a point which the teacher should look to; and when clavicular elevation is distinct, she should draw the attention of the pupil to the fact, and cause her to alter her mode of dress, and to use the diaphragm instead of the muscles in the neck. I use the female term advisedly, because the evil is most prevalent among women, but it is not limited to that sex. Men and boys wear belts and tightly-fitting waistcoats, which interfere very much with continued vocal exertion. In former days the stocks which enveloped the throat, and the 'Masher' collars of the present era, have the same evil tendency. They are unnatural, and, as such, must be injurious to humanity, especially to healthy muscular growth.

Vocalists and orators must be natural in their actions.

Vocalists and orators should always be natural if they wish to excel. Imitation is a sustained effort, which will fail in its real object. Inspiration and expiration must be so managed as not to be forced. The position of the body must be easy, and no muscle of any kind put upon the stretch in positions which are not natural to it. Vocal gymnastics may be useful in overcoming defects of voice and tone, but they should be used under proper supervision, and for a special object. Singers in public are obliged to study time as a part of their education. Public speakers forget that time is necessary to enable the waves of sound to pass to all parts of a large assembly. Speakers, therefore, who speak in too high a key, or too loud in tone, or too fast, should pay some attention to vocal gymnastics if they are desirous to overcome their defects. Rapid speech does not give time for the hearers to understand the terms used. Vibrations succeed each other too fast for comprehension, and as a consequence there is inattention among the audience. The voice should not be much louder than that which is used in ordinary conversation, and the rapidity of utterance should be so managed that the larger the audience the further the waves of sound have to travel, and time must be allowed for their return before the next sentence is propelled into space.

In public speaking the voice must not be raised much above the natural tone.

The reflection from the walls and roof of the room throws the sound of the voice back among the audience, and there must be time for this reverberation to cease if the speaker is to command attention. The great difficulty in elocution is to be slow without appearing to be slow, to have a measured distinctness without absolute intervals of waiting for the next word.

We should not put an emphasis upon the consonants, and let the vowels slip out as if of no consequence; but a study of the defects of voice and speech is beyond our present scope.

CHAPTER XIX.

THE MOUTH AND TEETH.

Offensive breath.

OFFENSIVE breath, whether in teacher or pupil, is most disagreeable to the other. To have the smell of onions or of garlic, the odour of oxidizing alcohol, of stale tobacco, or the exhalation of sulphurous fumes, are each and all disagreeable enough. Offensive breath is produced by different causes. It may be due to constitutional defects quite unconnected with the condition of the teeth. There is a smell from some habitus in the breath, which is at times extremely disagreeable to the person affected, as well as to the bystanders, but as a rule the author of the smell is unaware of it.

Causes various.

When it is due to exhalation from the pulmonary membrane, there is a defect in the blood which requires to be put right. The defect is most prevalent amongst girls at the time of the monthly change which naturally belongs to them. It requires to be met by a blood purifier, such as a teaspoonful of the phosphate of soda taken daily, in a tumbler of water, and a brisk purge monthly, shortly before the flow begins.

Offensive breath is more usually connected with dental decay. Some of the teeth are carious; food is allowed to remain in the cavities until it putrefies, and sets up further mischief in the tooth itself, as well as in the general health of the individual. Such teeth will also have large quantities of so-called *tartar* gathered round their crowns, and, by decomposition in the tartar, set up offensive miasms in the mouth, which eventually are felt by the subjects of it, though at first it is scarcely perceived by them. These conditions are such as ought not to be. We cannot always prevent the teeth from decaying, but we can prevent the decay of food in the hollow teeth, and we can prevent the formation of tartar around the crowns of the defective teeth. Tartar indicates the presence of living organisms in the mouth. It is an evidence of the existence of bacterial colonies,—nests of living creatures in the mouth,—which must be dislodged from their settlements before the mouth can be rendered pure again. The tartar must be scraped from the teeth, and the mouth washed out frequently with some antiseptic. A teaspoonful of Condy's fluid in a pint of water may be used several times a day. A solution of borax, a teaspoonful to half a pint of warm water, should be used occasionally, and the teeth carefully cleaned with animal charcoal. The charcoal should be pushed into the hollow teeth, and allowed to remain after the cleaning has been completed. It will arrest change, and prevent smell from the decomposition which has taken place. Those who have offensive breath should cleanse the mouth after every meal; be careful to remove all particles of food from between the teeth, as well as out of the hollows. The colonies of bacteria will be soon destroyed by this process, especially if charcoal be used, and the breath will then be rendered sweet again. The bacteria act upon the food much as the yeast plant does in promoting alcoholic fermentation. The creature sets up a change in the food and saliva,

Bacteria; cause, deposit of tartar.

multiplies itself immensely, separating the material at hand into gases, which smell, and into *débris*, some of which forms the tartar. The whole of the tenants must be completely dislodged from the mouth before a cure can be effected. This dislodgment can be only brought about by continuous attention to the mouth, and the daily use of charcoal or other similar disinfectants (see page 226).

The teeth have a definite use; they are for the mastication of food, and their use promotes the secretion of saliva from the glands which are beneath the tongue and at the angle of the lower jaw.

Mastication a necessary part of digestion.

If a person does not use the teeth for masticating the food, the stomach has to perform a work which does not ordinarily belong to it. Digestion also is imperfect, for the mixture with saliva is a necessary part of the process. The saliva is alkaline during secretion. It is an active solvent, and it contributes to the perfection of taste, as well as increasing the easy solution of the food. If this alkaline solvent is not thoroughly mixed with the food, the soluble albumenoid and gelatinoid bodies which exist in food are not placed in the best position for being acted upon by the gastric juice; the starch granules are not changed into dextrin, and afterwards into glucose or grape sugar, in the rapid and easy way by which saliva is able to change them and make them ready for absorption.

Thus it is at once seen that mastication is an important part of the digestive process, and for this operation the teeth are necessary. If they have decayed in early life, it is a great advantage to health and happiness that a false set should be provided. It is of more importance to the individual that the false set should be for use than it is to have them for

When having false teeth, have back as well as front teeth renewed.

ornament,—that is, that the back teeth should be provided in preference to the front teeth. The latter are important for the perfect formation of words, but correct speech is secondary in importance to digestion; and I would urge teachers, therefore, to have a complete set rather than only two or three of the front teeth restored. The restoration of the front teeth improves personal appearance and speech, but to leave the back teeth unrestored in consequence of the expense, and do that for appearance sake which should be done in preference for health, is not good policy. I advise every one having defective teeth to consult an established dentist of good repute, and to submit to the expense of a new set, rather than continue to suffer from the miseries attendant upon indigestion, which is sure to be the outcome of carious teeth. Decay takes place sooner or later: the incidence of a bastard civilisation is increasing the tendency to dental decay. Hereditary diseases manifest themselves very early in the development of the teeth. The first set often fail because such diseases as tubercle and syphilis have invaded the parent stock. There is a peculiar notched, irregular appearance in the front incisors which are evidences of hereditary taint; all such cases should be under the care of an experienced dentist. Teeth so circumstanced are not capable of resisting the action of some acid foods, and are rapidly acted upon by some saccharine matters which contain in their solutions a slightly acid reaction. The mouths of children which indicate these states should be frequently examined. Irregularity of position also tends to decay; but I am bound to say that such irregularity is more often produced by injudicious interference with the second set, or by injudicious removal of the milk teeth before the second set are

Second set must not be rashly extracted.

ready to take their place, than because Nature cannot perfect her work. I have known first teeth taken out because a tooth of the second set has pushed itself prominently forward in the rear of the first. This is really the proper position of the second set of incisors. They are in the middle line of the mouth, and must be in the rear. The semicircle of the jaw in the child is smaller than in the grown-up person, and as a consequence the larger semicircle cuts through the smaller; the second set naturally coming behind the first, for the jaw is larger in the older person, and it widens as the chin becomes less prominent. I always advise in such cases that the teeth should be let alone, unless they are being cut diagonally to their proper line. They get quite right in time.

The teeth are liable to injury if they are improperly used. Seamstresses, by constantly biting the thread of their sewing cotton, wear away a tooth, and so lead to its early decay; the injudicious mastication of hardened substances will cause teeth to wear away faster than they should do.

It is important to keep the teeth thoroughly cleaned after taking food, if they are irregular or decayed. It is not so necessary if they are all sound; decay allows of fermentation, fermentation produces acid secretion, acid secretion acts upon exposed dentine; and so, if the enamel is removed from any part of the crown or neck of a tooth, the enemy finds admission, and decay goes on at a more or less rapid rate.

Causes of toothache.

Toothache may arise from a variety of causes, but if there is extensive caries it can only be palliated. A slight removal of enamel may be remedied by stopping, and so preventing the action of reagents upon the dentine, and decay is arrested for a time. If caries is extensive, it is best to have the offender removed; but be careful not to have a tooth extracted because it is painful or tender to the touch. The teeth as well as other structures are liable to rheumatism, and to remove a rheumatic tooth is a mistake. The disease should be constitutionally treated. Gum-boils and abscesses in the mouth have already been dealt with (*vide* p. 223), and I need not repeat what has been previously said upon these points. Let me remark that a great number of teeth are sacrificed from impatience to bear pain. Early attention would save the teeth. Natural teeth, even if not quite sound, are much more satisfactory in their use than artificial ones; but if there is a dead tooth in the jaw-bone it is useless trying to keep it there, for it will only set up inflammation in the jaw-bone, and lead to further mischief to the neighbouring teeth which may yet be quite sound. There is always a desire for immediate relief from the intense pain of toothache; impatience of suffering is common to mankind, and we are seldom stoical enough to endure it without trying some so-called remedy or other,—which, however, in most cases will but perpetuate the evil. Find out the cause of pain. Is there a hollow in the crown, pressure is produced by food jammed into the hole. The removal of the plug, provided the nerve is not injured in removing it, will get rid of the pain. The hole should then be protected by some soft plug, such as medicated cotton wool, so that food may not again find its way into the hollow tooth very easily. Sometimes the pain is caused by fermentation of food, which produces an acid reaction, the acid acting chemically upon the exposed nerve. The fermentation should be arrested and its cause removed, the cause being animalculæ such as vibrios or bacteria, which require to be

Treatment.

destroyed in the manner already suggested. If the pain arises from direct injury, such as a fish or other bone pricking the nerve pulp, it will subside in a few hours if the pain be submitted to. Warm fomentations may be used frequently. The application of strong spirits, such as spirits of camphor, oil of peppermint or cloves, chloroform, and other similar applications, occasionally give instant relief; but the relief is only temporary, and is sure to be followed by increased pain in consequence of the inflammation, which is added to by the effect of the reagent employed. It is purchasing present relief at the expense of future suffering. If warm water relieves the pain, it will do no harm. If cold water is comfortable, it may be used. But if, after the use of diluents and remedies for checking fermentation, the nerve be protected from the effect of cold applications and cold air, it is much better to bear with it, and wait until the process which causes the pain has been completed, when it will cease altogether. If the pain is rheumatic, no local applications can help it much, whilst they will certainly increase the inflammation, and perhaps lead to gum-boil. If it is caused by a loose tooth or a bit of a fang which is irritating the gum because the bony part is dead, the fang or loose tooth should be extracted.

A term is sometimes used by dentists which is incorrect. They apply some arsenic or other caustic paste for the purpose of 'killing the nerve.' The application destroys vibrios and bacteria, but does not destroy the nerve. A tooth without a nerve is a dead tooth, and had much better be removed than kept in the jaw.

Use of tooth-brushes and tooth-powder.

It is requisite to say a few words regarding tooth-brushes and cleansing the teeth. It is not force, but tact, which cleans teeth. It is very mischievous to scour them as if they were copper kettles. It is the interstices between the teeth, and the unnatural hollows from irregularities, which require to be cleansed from food. A moderately soft brush, which allows the hairs to enter between the teeth and dislodge deposit, is the best instrument. Rinse the mouth well after food with water, and clean the interstices on going to bed at night, and you will help to stave off disease and save the teeth from decay. If there be carious teeth, the best tooth-powder will be animal charcoal. Chalk is sometimes used, but it is not always advantageous. Slightly antiseptic solutions may be used, but water and tact are all that are really necessary, whilst acids and hard powders are sure in the long run to be hurtful. A mixture of finely-powdered chalk and orris-root powder will be as little hurtful as any of the compounds which are usually sold for the purpose.

When the gums are soft, spongy, and bleeding very easily, styptics, such as strong infusion of tea, containing some preparation of creosote, are useful applications. In such cases the assistance of the medical adviser should be obtained, for the patient is likely to go from bad to worse unless the evil which produces such a result is remedied.

CHAPTER XX.

FAMILY MEDICINES.

Family medicines.

I PROMISED to say a few words upon the use of family medicines. When any one becomes accustomed to physic himself or his household, he is much more liable to do wrong than right. Such an one likes to see an effect produced by his remedy. He throws in calomel, antimony, aloes, ipecacuanha, or tartar emetic with heroic indifference to the ultimate result, and as a consequence, disease is fanned into activity, as often as it is extinguished. It is very unwise to use edged tools without knowing the nature of the material which you propose to cut. I am opposed to anything like pretence, otherwise I should advise individuals who are anxious to do a little physicking upon their own account, to prescribe so-called homœopathic remedies; they will not do any harm with them, and they will let disease follow its natural course without increasing its impetus by powerfully-acting medicines. To pretend to do something, and to do nothing, is not science, and I cannot uphold it. I will give a few hints as to the use of aperients, febrifuges, sedatives, expectorants, diaphoretics, tonics, etc., so far as their use is justifiable by unskilled hands, premising that a judicious application of dietetics is very

Don't use edged tools.

often of much greater service than that of active medicine.

If a person's appetite fails him, it is unwise to tempt it with niceties. Let food alone until appetite returns; and especially in the case of young people, abstinence from food will bring about a cure. If there is nausea, headache, constipation, with foul tongue, etc., a liquid diet and a simple aperient will perhaps be the best treatment. In such cases the nauseous compound called Gregory's powder is the safest, and at the same time the most efficacious. If there is no nausea, a little castor oil is safe, or we may use some effervescing saline which contains a simple salt. If there is thirst, a teaspoonful of Epsom or Glauber salts in a tumbler of warm water may be taken. I urge all unskilled persons to let calomel and other metallic aperients alone. They apparently produce very satisfactory results, and the operator feels inclined to repeat the dose; but he is using an edged tool which may cut in more ways than one. I always advise amateurs to put such weapons aside, and trust only to abstinence and simple remedies. There is a class of medicines called alteratives, in which mercury is generally an ingredient. If they are necessary, skilled advice should be sought. They are remedies which ought not to be tampered with; for mercury or antimony enters more or less into their composition. The mineral waters such as contain the sulphates and carbonates of the alkalines or salts which go by the name of Epsom, Glauber, Cheltenham, or Carlsbad salts, are usually safe aperients if taken in hot water early in the morning; a teaspoonful taken daily is a far better plan in obstinate constipation than taking a large quantity once now and then. It is also more satisfactory than the custom

Simple aperients.

of taking a dose of aloes. The latter are likely to produce a tendency to piles, though a grain or two of compound rhubarb pill taken daily before dinner will occasionally help digestion and improve appetite. The dose has to be continued for months to be of real service, and must not exceed four grains, whilst two and a half will generally be sufficient if persevered with long enough, and the patient dieted with fruit and vegetables.

The best febrifuges are simple diluents such as barley water, and slightly effervescing drinks not containing alcohol. Packham's aerated waters, which are made with distilled water, are the very best which can be procured; a visit to the manufactory in Katharine Street, Croydon, will be well repaid, for the care which is taken to exclude all injurious matters from the waters is very manifest to those who will take the trouble to look for themselves. There is no chance of typhoid germs or metallic contaminations finding admission into the bottles, for the minutest detail is watched, and all sources of insanitary action carefully guarded against. I know of no febrifuges so satisfactory as Packham's seltzer, potass, soda, and other mineral waters, which act as diluents, and assist to flush out the human sewers which exist in the kidneys, the skin, and the bowels.

In almost all cases of digestive derangement, it is better to fast from animal food, and take diluents in abundance, than to tempt the appetite with luxuries.

Sedatives and narcotics should never be taken by amateurs.

Sedatives should never be given by the amateur; if they are really beneficial, the effect is only temporary, and the dose requires to be increased the next time the medicine is taken, and so a foundation is laid for future evil. Expectorants, by promoting the secretion of phlegm in cases of catarrh, may be useful. The safest form is the syrup of squills, or a few drops of ipecacuanha wine, frequently repeated. They will also act as diaphoretics if freely associated with diluents; but to take ipecacuanha wine, and then go out into the cold and raw morning air is unsafe. You have opened a door to let out morbid matter by relaxing the skin and losing heat, by which you render the body more susceptible to danger. It is far better in such catarrhal conditions to use some slight astringent, such as the compound infusion of roses, or tannin lozenges, than to use expectorants and diaphoretics when the patient must be exposed to the influences of damp and cold air immediately afterwards.

I often hear persons say they are taking a tonic. They want tone, they are feeling weak, and think that a glass of port wine and a grain or two of quinine two or three times a day will do them good. These persons are like to a man whose apartments being dilapidated, and the walls grimy with dirt, sets to work to paper and paint them up before they are cleansed and the cracks remedied by proper means. His work is in the wrong direction to start with. Such exhibitions of tonic remedies are delusive as to results, and are cementing in the system the causes which produce the weakness. To pile on the tonic because it may do good is a very bad practice. No medicinal agent should ever be administered except upon a truly scientific basis, for if fresh air and pure water be supplied, and there is temperance in the use of food and in application to work, active and otherwise useful medicines will be much better left alone by amateurs.

Conclusion.

My task is now completed. The glance at the medical aspect of life, when given in popular language, must necessarily be cursory and superficial. If any exhaustive treatise is attempted, the writer is sure to pass into regions which are too professional for ordinary people. I have tried to avoid that fault; I may have erred upon the other side; if so, I crave my reader's indulgence, in consequence of the difficulty of being popular without being either too professional or passing into the region of quackery,—that is the last thing I should wish to accomplish. If, however, my directions shall be the means of preventing some disease among our youth, my object will be accomplished.

INDEX.

A

Abrasions, 176.
Abscess and its allies, 216.
Acids, corrosive, Effects of, 233.
Acne, 203.
Acute laryngitis, 336.
Acute sore-throat, 333.
Æsthetical exercise, 131.
Air, Composition of, in schools, 70.
Air, Movement of, 82.
Air must be warmed, 77.
Air required per hour, 74, 81.
Alkalies, caustic, Effects of, 234.
Amaurosis, 301.
Ambulance drill, 247.
Anæmic headache, 287.
Anerley school, 128.
Aneurism, 178.
Animal fats in Arctic regions, 268.
Ankle, Dislocation of, 253.
Anthrax, or carbuncle, 196.
Antibilious states, 276.
Antiseptic dressings, 232.
Aperient medicines, 275.
Aphthous sore-throat, 334.
Apoplexy, 243, 247.
Arnot's stove, 90.
Arteries, Injuries to, 178.
Asphyxia, 243, 247.
Astigmatism, 305.
Athletics for girls, 130.
Atrophy, Muscular, 123, 278.

B

Bacteria in mouth, 351.
Bare feet in schools, 331.
Bass and tenor, 344.
Bathing, Dangers of, 56.
Baths and bathing, 52.
Baths, Temperature of, 60.
Bedroom, Use of, 106.
Bedrooms, Ventilation of, 112.
Beds to be ventilated, 111.
Biliousness, 276.
Boils, 192.
Boots and shoes, 158, 331.
Bowditch's observations, 153.
Boyle's ventilator, 95.
Brabazon's views, 161.
Brain disturbance, 244.
Brain work, Time required for, 138.
,, and rest, 126.
Breaking of voice, 344.
Brown & Green's stoves, 90.
Brushes and combs, 110, 168.
Bullæ, or blebs, 211.
Bunsen's burners, 86, 88.
Burns and scalds, 229.

C

Cankers, 223.
Carbonic acid, CO_2 in air, 71.
Carbuncle, or anthrax, 196.
Catalepsy, 244.
Cataract, 301.
Catarrhal ophthalmia, 298.
Centre-grate stoves, 91.
Certificates, 140.
Cesspools, 43.
Chilblains and chaps, 198.
Children not to sleep together, 108.
Chimneys for ventilation, 84.
Chloroform and thieves, 241.

Choking, 241.
Chronic abscess, 217.
  ,, sore-throat, 337.
Classification of children, 310.
Cleanliness in dormitory, 111.
Clergyman's throat, 325, 337.
Closed stoves, Effect of, 86.
Clothing in skin disease, 214.
Coal gas for lighting and warming, 97.
Cold bathing, Danger of, 59.
Collar bone, Dislocation of, 254.
Coma, 244, 247.
Communication with sewer, 29.
Compass of voice, 342.
Compression and concussion, 244.
Concrete, Sewers to be laid on, 31.
Congestive headaches, 292.
Conservation of energy, 263.
  ,, of force, 263.
Contralto and soprano, 344.
Contused wounds, 177.
Convulsions, 244.
Co-ordinating power in eyes, 303.
Corns and bunions, 159.
Corporal punishments, 141.
Correlation of force, 263.
Corrosive acids, 229.
Costume, School, 155.
Cramming, Disadvantages of, 162.
Cross lights, Objections to, 102.
Crowds produce draughts, 96.
Cubicles, Size of, 106.
Cubic space, 69, 80, 108.
Curved spines, 146.
Cutaneous maladies, 192.

D

Damp course in walls, 62.
Dandriff, 207.
Dangers of bad ventilation, 79.
  ,, of excessive exercise, 122.
  ,, attending use of traps, 37.
  ,, of hot baths, 55.
  ,, of use of goloshes, 332.
  ,, from use of narcotics, 283.
Davenport after Roth, 153.
Deafness, 311, 319.
  ,, from inattention, 321.
  ,, preventible, 322.
Death-rates reduced, 136.
Desks and seats, 150, 152, 153.
Devil's tattoo, 136.
Diagram of bad site, 24.
  ,, of improved site, 24.
  ,, of sewer ventilation, 40.
  ,, for bedroom ventilation 113.
  ,, for plan of warming, 87.
  ,, of shape of foot, 159.
Diameter of drain pipes, 33.
Diaphram, Use of, by vocalists, 3[illegible]
Diet in skin diseases, 214.
Diffusion of gases, Law of, 76.
Digestion and its derangement, 267.
Dipstone traps, 38.
Diphheria, 336, 337.
Discord in music, 341.
Dislocations, 249, 251.
Dog bites, 185.
Dormitories, 105.
  ,, not for study, 105.
  ,, Cubic space of, 108.
Doulton's slow combustion stove, 94.
  ,, Trap, 32.
  ,, W.C., 48.
Drainage of schools, 28.
Drain pipes (fig. 4), 28.
Drains to be ventilated, 41.
Dress drill, 156.
Drowning, 235.
Drunkenness, Signs of, 247.
Dry areas, 22.
Dyspepsia, Causes of, 273.

E

Earache, 313.
Ear, Description of, 312.
  ,, Discharges from, 316.
  ,, trumpets, 320.
Earth-closets, 43.
Ecthyma, 212.
Edinburgh chamber traps, 30.
Education, Objects of, 160.
Edwards' stove, 90.
Eczema, 207.
Electric light, 100.
Energy, Actual, 264.
  ,, Potential, 264.
Entrances for fresh air, 95.
Epilepsy, 244.
Erysipelas, 191.
Eustachian tube, 313, 317.
Examinations, 139.
Exanthemata, 171, 202.
Exercise, Necessity for, 278.
  ,, Excessive, injurious, 122.

Exercise expels CO_2, 120.
  ,, increases power, 121.
  ,, objects of, 126.
  ,, produces sleep, 128.
  ,, promotes warmth, 119.
  ,, varieties of, 126, 278.
Exits for foul air, 95.
External ear, 312.
Eyes, 294.
  ,, Foreign bodies in, 294.
  , Inflammation of, 296.
  ,, Injuries to, 294.

F

Fainting, 243.
Fall in sewer, 28.
False teeth, Use of, 353.
Family medicines, 352.
Fat, Formation of, 122.
Fatigue, Necessity for, 282.
  ,, produces sleep, 283.
Fetid breath, Causes of, 226.
Filth diseases, 39.
Fish-skin disease, 208.
Floors of school, 63.
  ,, to be cleaned, 103.
Floor space, 69, 81.
Flushing of sewers, 54.
Follicular sore-throat, 337.
Food, Use of, 265.
  ,, Animal, 268.
  ,, Vegetable, 268.
  ,, Changes of, 269.
  ,, Nitrogenous, 271.
Foot-warmers, Evils of, 331.
Foreign bodies in windpipe, 242.
Foundations of disease, 8.
Fractures, 256.
Frost-bite, 201.

G

Galton's ventilating fire-place, 89.
Gas for warming purposes, 87.
Germs, Growth of, how prevented, 39.
Girls require muscular activity, 130.
Glaucoma, 301.
Globus hystericus, 340.
Goloshes, Dangers of, 332.
Good-humour in school life, 138.
Gouty diathesis, 273.
  ,, ear, 316.
Ground-air, 15, 18.
Ground-water, 16.
Growth of body, 262.
Gumboils, 223.
Gun-shot wounds, 190.

H

Hair oil prohibited, 111.
Half-time system, 135.
Harberton's, Lady, system, 157.
Headaches, Congestive, 292.
  ,, Anæmic, 287.
  ,, from fulness, 287.
  ,, from impure blood, 289.
  ,, from miasms, 289.
  ,, Nature of, 287.
  ,, Nervous, 291.
  ,, Sick, 291.
Head or hair drill, 168.
Hearing and the ears, 311.
Heating schools by hot water, 92.
Hedozone, 298.
Hereditary taint, 12.
Herpes, or tetter, 210.
'Herpes Zoster,' 211.
Hip, Dislocation of, 254.
Home lessons, 137.
Hopper stoves, 91.
Hot baths, Construction of, 61.
  ,, Dangers of, 55.
Hours required for sleep, 116.
Hydrophobia, 186.
Hypermetropia, or long sight, 305.
Hysterical children, 144, 248, 340.

I

Idleness promotes fat formation, 122.
Impervious sewer pipes, 29.
  ,, walls, 64.
Impetigo, 212.
Impurities from skin, 78.
  ,, in breath, 78.
Incised wounds, 177.
Incontinence of urine, 115.
Infant mortality, 6.
Infectious diseases, Rules for, 165, 169, 175.
  ,, Duty of principal in, 171.
  ,, Medical certificate in, 166.
  ,, Time of incubation, 173.

Injury to blood-vessels, 177.
Inspector of nuisances, 47.
Intemperance in exercise, 280.
Intelligent supervision, 98.
Intensity of voice, 342.
Iritis, 300.
Itch, or scabies, 169.

J

Jaw, Dislocation of, 255.

K

Knee, Dislocation of, 255.

L

Lacerated wounds, 179.
Land-locked valleys, 21.
Laryngismus stridulus, 340.
Larynx, Structure of, 326.
Lateral curvature and short sight, 148.
  ,, curvature and position, 146, 149.
Lepra, or leprosy, 205.
Lice, 213.
Lichen, 204.
Liebreich's lecture, 310.
Lighting, warming, ventilating, 84.
Lights and shadows, 98.
Ling's Swedish system, 131, 136.
Lockjaw, 181.
Long sight, 305.

M

Mastication, Nature of, 270, 352.
Medical certificates in infectious cases, 166.
Medical officer of health to be consulted, 172.
Miasms from old clothes, 155.
Moral punishments, 141.
Morbid foci, 11.
Mouth, Diseases of and in, 223.
Movement of air, 82.
'Move on' applied to filth, 38.
Muscæ volitantes, 302.
Muscle to be exercised, 118.
  ,, wasted if not used, 121.
Muscular atrophy, 280.
  ,, palsy, 280.
  ,, sense, 281.
Musicians and deafness, 322.
Myopia, or short sight, 305.

N

Naked feet, Advantages of, 158.
Narcotics, Dangers of, 283, 360.
Natural drainage, 14.
Nature of made ground, 15.
Nervous headaches, 291.
Nimia cura medici, 164.
Nitrogenous food, 271.
Nose, Purpose of, 332.
Nuisance inspector's duty, 47.

O

Oblique light, 100.
Offensive breath, 350.
Old sight, 305.
Opacity of cornea, 299.
Ophthalmia, 296.
Orators to be natural, 325.
Organs of voice, 327.
  ,, of speech, 326.
  ,, of hearing, 311.
Overcrowding in schools, 68, 72.
  ,, in dormitories, 107.
  ,, produces draughts, 73.
Overpressure, 136.

P

Payment by results, 161.
Peptones, Action of, 271.
Physical education, 131.
  ,, exercise, 118, 140.
Pitch, or range of voice, 342.
Pityriasis, or bran-skin, 207.
Poisoned wounds, 183.
Poisonous gases, Action of, 243.
Policeman's motto, 38.
Polypi in ears, 317.
Presbyopia, or old sight, 305.
Prevent growth of germ, 39.
Prizes, 140.

Problems of ventilation, 77.
Professional muscular atrophy, 123.
Psoriasis, 206.
Punctured wounds, 182.
Punishments, 141.
Purulent ophthalmia, 298, 299.
Pustular ophthalmia, 296.
Pustules, 212.

Q

Quality of voice, 341, 342.
Quinsy, 221, 334.

R

Rabid dogs, 190.
Rainfall, 26.
Rainwater pipes, 33.
Rays of sun, 27.
Respiration, Arrest of, 239.
Respirators, Use of, 329.
Rewards, 139.
Rheumatic diathesis, 274.
Right-angled pipes, 29.
Right-handed work, 147.
Rights and lefts (shoes), 159.
'Rima glottidis,' 327.
Ringworm, 167.
Roaring, or second wind, 124.
Roof of schoolhouse, 26.
  ,, ,, domed, 100.
Roth's hygienic chair (fig. 29), 153.

S

Sailors and sore-throats, 326.
Scabies, or itch, 169.
Scalds and burns, 229.
Scaly diseases, 205.
Scarlet fever, Isolation in, 172.
Scholarships, 140.
School buildings, Construction of, 62–65.
  ,, caps, 157.
  ,, costume, Uniform, 155.
  ,, desks and seats, 146.
  ,, surgery, 163.
Schoolroom ventilation, 65–68.
Second wind, 124.
Sedatives and narcotics, Evils of, 360.
Sedentary occupations, Effect of, 273, 274.
Sewage, Pollution of site by, 23.
Sewer flushing, 54, 58.
Sewers, Requirements as to, 34.
  ,, to be flushed, 34.
  ,, to be laid on concrete, 31.
Sex and voice, Training of, 340.
Sherringham ventilator, 114.
Shingles, 211.
Short sight, 305.
  ,, Causes of, 148.
Shoulder, Dislocation of, 251.
Sick headaches, 291.
Simple catarrh, 333.
Singing and tight lacing, 348.
Site of school, 14.
Sites to be avoided, 24.
Skin diseases, 203.
Sleep, Hours required for, 116.
  ,, why required, 285.
  ,, when necessary, 285.
  ,, must be regular, 286.
Slow combustion stoves, 94.
Small-pox, Isolation in, 172.
Smoking, Effects of, on throat, 324.
Snake bites, 184.
Song an acquired power, 328.
Soprano and contralto, 344.
Sore-throats of fevers, 332–335.
Spasmodic croup, 340.
Spectacles, Disadvantages of, 148, 308.
Spouting for roofs, 63.
Squinting, Causes for, 304.
Stagnation objectionable, 38.
Standard burners for gas, 102.
Starch and sugar as foods, 271.
Stoves, Galton, 89.
  ,, Arnot's, 90.
  ,, Brown & Green's, 90.
  ,, Centre grate, 91.
  ,, Edwards', 90.
  ,, Hopper, 91.
Strangulation, 239.
Stretcher, How to make a, 246.
Structure of throat, 326.
Study, Time required for, 134.
Styes, 220.
Suffocation, 239.
Sunlight, 27.
Suppuration, 181.
Swedish system (Ling's), 131.
Swimming bath, 52.
Sylvester method, 236.
Syncope, or fainting, 243.
Syphon traps (figs. 6 and 7), 32.

T

Tartar on teeth, 226.
Technical training, 161.
Teething and toothache, 224.
Temperature of baths, 60.
,, of human body, 265.
,, raised by crowds, 72.
Tenor and bass, 344.
Tetanus, or lockjaw, 181.
Throat, Diseases of, 324
,, Relaxation of, 326.
,, Inflammation of, 328.
Tight lacing, 157, 348.
Timbre (in voice), 341.
Tonics, 361.
Tonsils enlarged, 339.
Toothache, Causes of, 354.
Tooth powder, 356.
,, brushing, 227.
Total abstinence, 180.
Towels, 110.
Training, Muscular, 123, 126.
Traps, Disadvantage of, 37.
Trees near schoolhouses, 25,
Typhoid fever, 174.

U

Uniform for schools, 155.
Urinals, Construction of, 44.
,, Water supply to, 45.
,, Ventilation of, 45.

V

Vegetable food, 268.
Vegetation, Benefits of, 39.
Ventilation of house drains, 37.
,, of sewers, 35.
,, Objects of, 70.
,, Dangers of bad, 79.
,, of bedrooms, 112.
,, destroys disease germs, 41.
,, of water-closets, 41.
,, by open windows, 83.
,, by means of gas, 87.
Vesicles, 208.
Violent exercise, Danger of, 125.
Virgin soil, Nature of, 15, 22.
Vocalists to be natural, 348.
Voice, Management of, 324, 341.
,, not to be strained, 345.

W

Wall-burners for gas, 102.
Water-closets, Ventilation of, 41.
,, may be untrapped by use, 42.
,, Water supply to, 51.
,, number required, 46.
,, Construction of, 48, 49.
Wash-basins, 110.
Washing-places, 109.
Wasp stings, 183.
Watson's ventilator, 114.
Water supply, 51.
Wenham & Waters' hot-water coil, 93.
Wenham's gas-burner, 101.
Whitlow, 218.
Windows, Difficulties in regard to, 83.
,, Position of, 98.
,, Ventilation by, 83,
,, to be cleaned, 104.
Window space, Area of, 99.
Wrist, Dislocation of, 252.
Wounds, 176.

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